MAJOR RESEARCH PROJECT

LITERATURE REVIEW: Self-determination theory and exercise in severe mental illness and affective disorders: A systematic review

EMPIRICAL PAPER: An exploration of the associations between hypomanic traits, motives and exercise in the context of self-determination theory

Submitted by Lucy Williams, to the University of Exeter as a thesis for the degree of Doctor of Clinical Psychology, April 2018

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SCHOOL OF PSYCHOLOGY

DOCTORATE IN CLINICAL PSYCHOLOGY

LITERATURE REVIEW

Self-determination theory and exercise in severe mental illness and affective disorders: A systematic review

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Abstract

***Objective**:* Self-Determination Theory (SDT) has emerged as a useful framework through which to understand motivation for exercise. While relationships between SDT constructs and exercise have been well-established in the general population, only in recent years have these relationships been explored within clinical populations. This paper aims to review the nature of the relationships between SDT constructs and exercise for individuals with severe mental illness (SMI) and affective disorders.

***Method*:** A search was conducted of three databases: PsycINFO, PubMed and SPORTDiscus, for studies published prior to February 2018. From 981 studies after duplicates were removed, 12 independent studies of cross-sectional (n = 9) and experimental (n = 3) design met the eligibility criteria for inclusion.

***Results*:** Narrative synthesis of these studies provided consistent support for a positive association between autonomous motivation and exercise and a negative or null association with exercise for more controlled forms of motivation. Furthermore, SDT-informed interventions were found to increase exercise participation in both the short and long term. However, only one study examined motives for exercise, limiting generalisability. Similar findings were found across participants with diagnoses of SMI and affective disorders.

***Conclusions*:** These findings are in agreement with studies investigating these constructs within the general population, suggesting that SDT is well-placed to explore and promote exercise participation at a universal level. Further research using longitudinal and experimental designs would help to better understand the mechanisms by which individuals with SMI or affective disorders can promote and maintain autonomous motivation and exercise participation.

Keywords: Behavioural regulation; motives; physical activity; mental disorder; systematic review.

Introduction

This review aims to explore motivation for exercise from the perspective of Self-Determination Theory (SDT; Ryan & Deci, 2000) in populations with severe mental illness (SMI) and affective disorders. To date, research exploring motivation for exercise more generally in SMI populations has been reviewed (Farholm & Sorensen, 2016a, 2016b), as have specific SDT constructs for exercise within the wider population (Teixeira, Carraca, Markland, Silva, & Ryan, 2012). However, there is a gap in the literature with regards to specific SDT constructs for exercise in individuals with SMI and affective disorders. The following paper will therefore systematically review relevant studies exploring SDT constructs for exercise, or using SDT-informed exercise interventions, specifically in relation to these populations.

Physical Activity and Self-Determination Theory

The importance of exercise for both physical and psychological well-being has been well documented and is widely recognised as a key component in promoting and maintaining good health (Biddle, Fox, Boutcher, & Faulkner, 2001). It is therefore critical to consider the factors that impact exercise participation and how to promote exercise across the population (Penedo & Dahn, 2005). Within the general population, it has been found that motivation is a significant factor in exercise participation and sustaining exercise behaviour over time (Teixeira et al., 2012). SDT takes a humanistic approach to the study of motivation and well-being and provides a useful framework to understand motivational processes and exercise behaviours (Teixeira et al., 2012).

As a theory of motivation, SDT differentiates between ‘motives’, which are the outcomes that an individual is trying to pursue and ‘behavioural regulation’, which is the *processes* through which these motives are pursued (Deci & Ryan, 2000). Research by Sheldon, Ryan, Deci, and Kasser (2004) demonstrated that both motives and behavioural regulation have significant independent contributions to psychological well-being.

Motives and behavioural regulations are integrated through the concept of basic psychological needs, on which SDT is centred; these needs are autonomy, competence and relatedness (Deci & Ryan, 2000). It is argued that pursuing different types of motives will fulfil these needs to differing degrees; conditions that support the fulfilment of these needs foster more self-determined regulation and promote well-being (Deci & Ryan, 2000).

Behavioural regulation. SDT distinguishes between different types of motivation that *regulate* a particular behaviour; these are considered to be on a multidimensional continuum (Figure 1), varying in the extent to which the regulation is self-determined, i.e., emanates from within (Ryan & Deci, 2000).

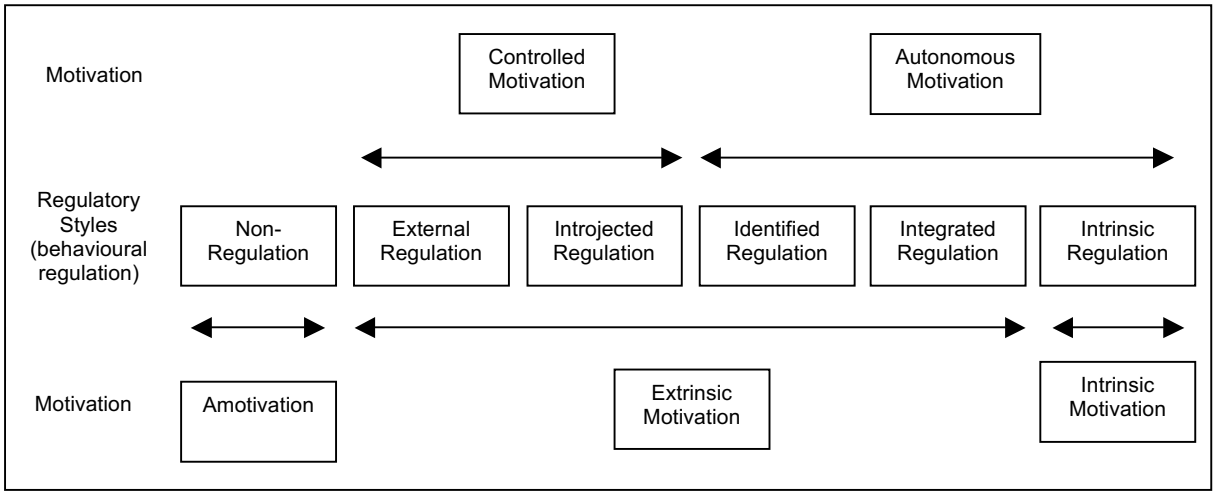

Figure 1. An illustration of the continuum of self-determined motivation, adapted from (Ryan & Deci, 2000).

SDT distinguishes between amotivation, extrinsic motivation and intrinsic motivation (Ryan & Deci, 2000). Applied to exercise, amotivation is defined as no intention to engage in physical activity, while extrinsic motivation involves exercising for outcomes separate to that of the exercise itself (Teixeira et al., 2012). SDT qualitatively differentiates types of behavioural regulations within extrinsic motivation (Deci & Ryan, 2000; Vancampfort, Stubbs, Venigalla, & Probst, 2015b).

The least self-determined form of extrinsic motivation is external regulation, followed by introjected regulation. External regulation involves engaging in physical activity to avoid punishment or obtain reward, while introjected regulation is where exercise is driven by self-approval, guilt or self-criticism; external and introjected regulations are also described as *controlled* forms of motivation (Teixeira et al., 2012).

Increasing in self-determination, identified regulation involves exercise being considered personally important, such as exercising because the resulting good health is valued even if the exercise is not enjoyable (Teixeira et al., 2012).

Integrated regulation involves exercising due to its congruence with an individual's sense of self, and finally intrinsic motivation involves engaging in exercise for the sake of that activity, as it provides enjoyment, interest or challenge (Vancampfort et al., 2015b). Intrinsic, integrated and identified regulation are all considered *autonomous* forms of motivation (Teixeira et al., 2012). It has been found that self-reported exercise is positively associated with autonomous motivation in the general population, with identified regulation more predictive of initial participation in exercise and intrinsic motivation predictive of long-term adherence (Teixeira et al., 2012).

Motives. Goal content theory (GCT) sits within SDT and distinguishes between intrinsic and extrinsic goals or 'motives' (Deci & Ryan, 2000; Vansteenkiste, Lens, & Deci, 2006). Intrinsic motives are so called because they are judged to fulfil SDT-posited psychological needs; they are considered to be associated with more autonomous forms of behavioural regulation and greater well-being (Deci & Ryan, 2000; Ingledew & Markland, 2008). Examples of intrinsic motives for exercise would include enjoyment, social relationships and personal growth (Deci & Ryan, 2000). Conversely, extrinsic motives would not fulfil psychological needs; examples in relation to exercise would include weight loss and body image (Ryan, Fredrick, Lepes, Rubio, & Sheldon, 1997). While an individual could hold a number of different motives for exercise, outcomes are considered to be determined by the relative prevalence of intrinsic or extrinsic motives (Teixeira et al., 2012).

While motives and regulations can be empirically crossed, research indicates that extrinsic motives tend to be associated with controlled regulations and intrinsic motives with autonomous regulations, consistent with predictions from SDT (Sheldon et al., 2004). Within the general population, research has found that intrinsic motives

for exercise are positively associated with sustained exercise participation (Ryan et al., 1997; Teixeira et al., 2012).

Physical Activity in Severe Mental Illness and Affective Disorders

More recently, researchers have begun to explore factors related to exercise in clinical populations, including SMI and affective disorders (Farholm & Sorensen, 2016a, 2016b; Vancampfort & Faulkner, 2014). Compared to the general population, mortality rate is two to three times higher for people with SMI and the most common cause of death is physical health difficulties (Crump, Sundquist, Winkleby, & Sundquist, 2013; Hayes, Miles, Walters, King, & Osborn, 2015). Reasons for such have been credited to unhealthy lifestyles, adverse effects from pharmacological treatment and biological factors (Roshanaei-Moghaddam & Katon, 2009). These populations have a higher risk of developing cardiovascular diseases, due to higher rates of health difficulties such as obesity and diabetes, which have the potential to be modified via lifestyle changes (Firth et al., 2016). In addition, exercise is associated with an improvement in psychiatric symptoms, suggesting that exercise as an intervention may both reduce health risks and improve general functioning (Firth, Cotter, Elliott, French, & Yung, 2015)

Despite the risks of sedentary behaviour, and benefits of exercise, research has shown that individuals with SMI and affective disorders engage in significantly less physical activity than the general population (Stubbs, Williams, Gaughran, & Craig, 2016; Vancampfort et al., 2016c). A number of barriers to engaging in exercise have been identified, including symptoms of psychiatric illness, physical health difficulties and side-effects of medication (Farholm & Sorensen, 2016a).

However, it is motivation that has been highlighted as one of the key barriers for individuals in these populations (Farholm & Sorensen, 2016a).

SDT for Exercise Findings in Clinical Populations

In recent years, SDT has been drawn on as a key theoretical framework as researchers attempt to understand the factors that influence participation and long-term adherence to exercise in clinical populations (Vancampfort et al., 2016a). Initial evidence suggests that motivational processes may not differ between the general population and clinical populations, with positive associations found between autonomous motivation and exercise and intrinsic motivation predictive of long-term adherence (Teixeira et al., 2012). As such, it may be that poor exercise participation in clinical groups is explained by the quality or 'type' of motivation not being conducive to initiating and maintaining engagement in exercise, i.e., more extrinsic in nature (Teixeira et al., 2012). It is suggested that understanding the motivational processes in these populations may be integral to targeting exercise interventions (Vancampfort et al., 2015b).

Vancampfort et al. (2015b) looked at differences in behavioural regulation for exercise between clinical groups and found that individuals with affective disorders had higher levels of introjected regulation for exercise than those with schizophrenia. Furthermore, Vancampfort et al. (2015a) found that introjected regulation was only significantly negatively associated with exercise behaviour for individuals with bipolar disorders (BD) and external regulation was only significantly negatively associated with exercise for those with major depressive disorder (MDD). However, these studies did not make comparisons with non-clinical populations, so it is not possible to conclude that the quality of motivation is different.

Few studies appear to have explored motives for exercise within clinical populations, but some evidence suggests that individuals with SMI may hold more extrinsic motives for exercise, such as body-related motives (Kane, Lee, Sereika, & Brar, 2012). However, Vancampfort et al. (2017) suggested that extrinsic motives can be as important as intrinsic motives with regards to adopting and sustaining exercise for individuals with psychosis.

Research to date has indicated that SDT may provide a helpful framework to understand and promote physical activity within clinical populations (Farholm & Sorensen, 2016a). However, while reviews have looked at SDT constructs in relation to physical activity within the wider population (Teixeira et al., 2012) and more recently at motivation for exercise in SMI populations more generally (Farholm & Sorensen, 2016a, 2016b), there is a gap in the literature with regards to specific SDT constructs in relation to exercise in clinical populations. As recent research has explored these constructs in the context of both affective disorders (e.g., Vancampfort et al., 2015a) and SMI (e.g., Farholm & Sorensen, 2016a), this review will include both populations to ensure a comprehensive review of clinical populations is conducted.

Review Question

The aim of this review is to explore the relationship between exercise and SDT constructs such as behavioural regulation and motives within populations with SMI or affective disorders. It will do so by focusing on the following review question:

- What is the nature of the relationship between the constructs of self-determination theory and exercise for individuals with SMI and affective disorders?

Method

To ensure that a methodological approach to a review is taken, it is recommended that a robust protocol is developed and reported; as such, this review adopted the preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P: Moher et al., 2015). This approach promotes transparency and research integrity (Moher et al., 2009; Moher et al., 2015).

Eligibility Criteria

Eligible studies were determined using the PICOS (participants, intervention/exposure, comparator, outcome, study design) criteria, in line with the PRIMSA guidelines (Moher et al., 2009).

Participants. Studies were eligible where participants were over the age of 18 and either from clinical populations with a diagnosis of SMI or affective disorder, or from a non-clinical population identified as high risk, e.g., depressive symptoms indicative of clinical depression, determined by standard cut-offs recommended by the developers of the scale used. Studies with samples of children, adolescents or competitive athletes were not deemed eligible for inclusion; this was due to the specificity of exercise in these groups being distinct from exercise participation in adults in general (Teixeira et al., 2012).

Interventions/exposure. Eligible studies reported quantitative empirical data on self-determined motivation for exercise, where motivation is defined (based on SDT) in terms of a continuum, increasing in self-determination. This review included studies that used a composite self-determination score of motivation, separate

scores for distinct types of regulation and scores combined into autonomous and/or controlled regulation. It also included studies that have explored motives for exercise and intervention studies that used an SDT-informed exercise-based intervention, looking at the relationship between physical activity and mental health.

Comparator. Applicable to experimental studies, no studies were excluded based on the comparator used. Studies were included if they used a control group and/or alternative intervention.

Outcomes. Included studies measured physical activity/exercise, either via self-report or objective measures such as pedometers or accelerometers; the terms physical activity and exercise in this review are used indiscriminately. Physical activity/exercise is operationalised as purposeful physical activity aimed at improving health/fitness (Teixeira et al., 2012); this can be in the form of structured exercise, e.g., exercise classes, cycling, running, or less formal exercise such as walking or movement captured by accelerometer data.

Study design. This review included studies that were cross-sectional, where behavioural regulation or motives for exercise were measured in relation to exercise participation in a clinical or at risk population. It also included experimental designs, where an SDT-informed intervention was used in a clinical or at risk population with exercise measured as an outcome. Longitudinal or prospective studies that measured SDT-related variables in relation to exercise at different points in time were also eligible. Any records that were conference abstracts or editorials were excluded; qualitative studies and systematic reviews were also not deemed eligible

for this review. Additionally, studies were required to be published in the English language and in peer-reviewed journals; there was no restriction on publication date. Grey literature was not searched due to time limitations and difficulties accessing this material.

Search Strategy

Three databases were searched; PsycINFO, PubMed and SPORTdiscus. These choices were derived from previous reviews that have searched similar databases, in order to ensure that a comprehensive selection of records was found (Farholm & Sorensen, 2016a, 2016b; Teixeira et al., 2012). Searches were conducted for studies published from the inception of the database until February 2018, to certify inclusion of up-to-date research. Search items were determined by previous reviews in the area of interest (Teixeira et al., 2012; Farholm & Sorenson, 2016a, 2016b) and keywords of relevant publications (Table 1). The search terms captured three distinct concepts: ‘SDT variables’, ‘mental illness’ and ‘physical activity’. The Boolean operator ‘OR’ was used to connect similar terms within each of the three concepts and Boolean operator ‘AND’ was used to combine these terms across the three concepts. Truncated terms were denoted by *, searching all possible endings from that stem.

Table 1.

Terms used for systematic search.

Concept	Terms Used
SDT Variables	"Motiv*" OR "autonomous motivation" OR "controlled motivation" OR "intrinsic motivation" OR "autonomous regulation" OR "controlled regulation" OR "behavioural regulation" OR "self-determination" OR "motives" OR "goals" OR "basic needs"
Mental Illness	"Severe mental illness" OR "mental disorder" OR "mental illness" OR "bipolar" OR "bipolar disorder" OR "mania" OR "affective disorder" OR "schizo*" OR "psychosis" OR "psychoses" OR "depress*" OR "major depressive disorder"
Physical Activity	"Physical activity" OR "exercis*" OR "exercise behaviour".

Study Selection

Publications were searched by 'title and abstract', yielding a total of 1,250 articles, which were collated in Microsoft Excel; a manual search of the reference lists of 12 relevant studies was also conducted and one further paper was identified. Duplicates were removed, resulting in 981 records that were screened by title and abstract. These records were reviewed against the eligibility criteria and progressed to the full-text screening stage if they either met inclusion criteria or it was not clear that they could be excluded. An independent reviewer assessed 20 randomly-selected records at the title and abstract screening stage to make an independent assessment of whether they should be included or excluded from the full-text

screening stage; this yielded an inter-rater reliability of 100%. A total of 54 records were included in the full-text screening stage; all of these texts were accessible and were included or excluded based on the eligibility criteria, with the reasons for exclusion recorded. One of the papers from this stage described the rationale for a SDT-based intervention, the resulting relevant paper was searched for and this met the eligibility criteria for inclusion. The independent reviewer also assessed 10 randomly selected records from the full-text screening stage to make an independent assessment of inclusion or exclusion; again this yielded an inter-rater reliability of 100%. Figure 2 illustrates the search strategy, with the number of records included/excluded at each stage in accordance with PRISMA guidelines.

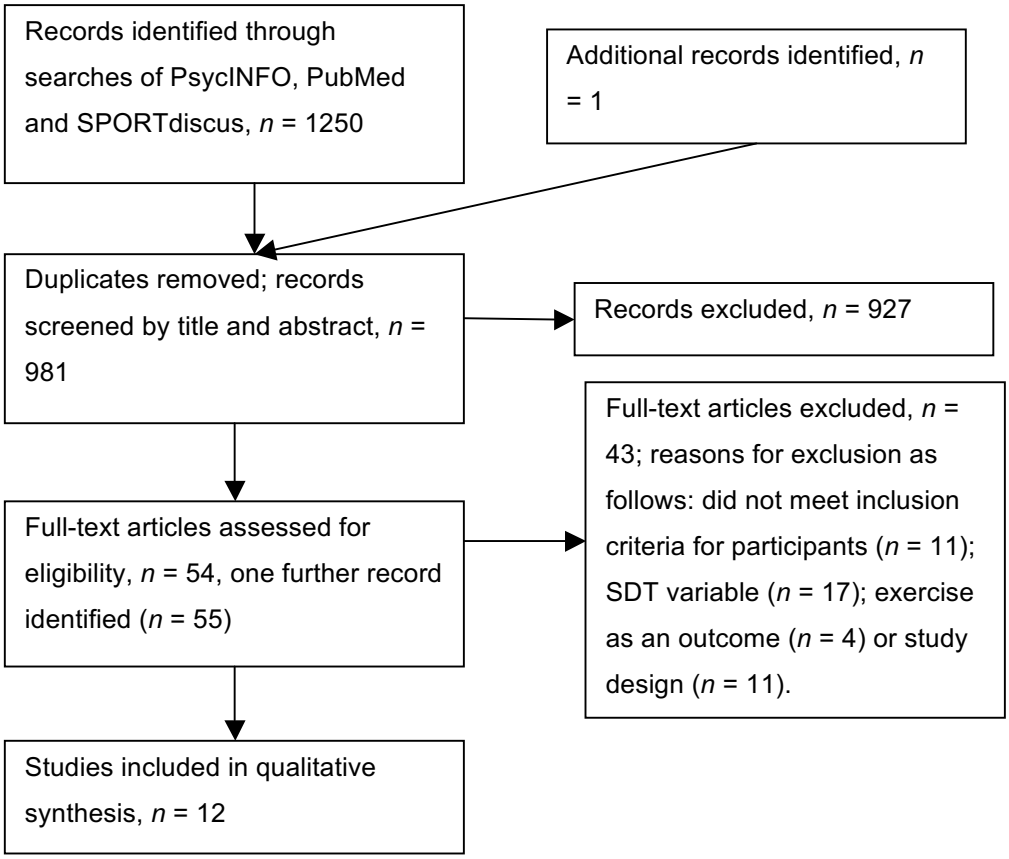

Figure 2. Flowchart of search strategy and included/excluded articles based on the PRISMA protocol (Moher et al., 2009).

Data Extraction

A standardised form was designed in Microsoft Excel to extract data of interest from the included studies; information extracted came under the headings of study reference, design, sample used, relevant measures and main findings. Data from included studies were summarised for the final collation of information (Table 2). The quality of the intervention studies was assessed against the Quality Assessment Tool for Quantitative Studies (The Effective Public Health Practice Project, 1998). This tool is a standardised measure of the quality of studies, reported to have acceptable content validity and test-retest reliability; it provides a methodological rating of weak, moderate or strong, based on eight areas of quality (Thomas, Ciliska, Dobbins, & Micucci, 2004). The quality of the cross-sectional studies was assessed against the Quality Assessment Tool for Observational Cohort and Cross-sectional Studies; this tool provides a quality rating of good, fair or poor based on a set of 14 criteria (NHLBI, 2014). The quality assessment tools used for included studies were chosen based on the balance of the relative designs of included studies. In addition, ethical considerations, use of valid and reliable measures, reference to recent research and effect sizes and power were considered. These limitations and overall quality ratings are summarised in Table 2. The independent reviewer assessed the quality of three studies included in the final synthesis. There was no disagreement as to the quality of the selected studies, either on the individual items or on the overall quality rating, again obtaining an inter-rater reliability of 100%. Studies were not excluded if of poor quality but were considered in light of their limitations.

Results

Table 2 organises the 12 studies which met the inclusion criteria by study design. The eligible studies yielded a total of 1582 participants (856 female); 785 (330 female) were categorised as having a severe mental illness and 797 (517 female) were categorised as having an affective disorder. However, there is overlap in these diagnoses, for example bipolar disorder can be classed as both an SMI and an affective disorder. Studies were predominantly cross-sectional (*n* = 9), with the remaining studies experimental in design (*n* = 3).

Table 2.

Summary of systematic search including study design, sample characteristics, measures, main findings, limitations and quality rating

Reference	Design	Sample	Relevant Measures	Main Findings	Limitations	Quality Rating
Study 1: Costa et al., 2018	Cross-sectional	114(28f) adults with schizophrenia. Participants recruited from seven health centres across Portugal treating individuals with schizophrenia.	BREQ-3 IPAQ	Autonomous motivation was significantly positively correlated with total physical activity per week (r = .25). Quality of life was significantly positively associated with autonomous motivation (r = .18) and weekly exercise (r = .33).	Symptoms of psychopathology were not assessed. Predominantly male sample.	QAT-OC **Fair**
Study 2: Farholm et al., 2017a	Cross-sectional	88(70%f) adults with SMI. Participants recruited through a public health network promoting exercise for people with SMI in Norway.	BPNES BREQ-2 PACE	A significant positive association was found between psychological need satisfaction and autonomous motivation (r = .65) and between physical activity and autonomous motivation (r = .41). A significant negative association was found between physical activity and amotivation (r = -.36).	Participants recruited through a physical activity promotion network and may therefore have more interest in engaging with PA than the rest of this population. Sample size was not large enough to run the full latent variable analysis of the hypothesized model.	QAT-OC **Fair**

Study 3: Farholm et al., 2017b	Cross-sectional	106 (65f) adults with SMI. All individuals with a SMI that met study criteria within a municipality in Norway were invited to take part.	TSRQ PCS IPAQ Accelerometer for *n* = 55 as objective measure	Physical activity was significantly positively associated with integrated regulation for self-report exercise (r = .55) and objectively measured exercise (r = .37).	Use of objective measure was not used by entire sample; history of PA was not recorded, this could have been an important factor in exercise participation. However, strong attempts were made to minimise bias.	QAT-OC **Good**
Study 4: Sorensen et al., 2006	Cross-sectional	109 (38f) psychiatric patients (SMI, unspecified). Participants recruited from 15 institutions that provide day care or residential care for individuals with SMI across Norway.	Adapted version of BREQ Self-reported physical activity	Exercise was significantly positively associated with intrinsic motivation (r = .21) and significantly negatively associated with extrinsic motivation (r = -.28)	Measure of self-determination reduced to 4 questions; lack of valid measures; different diagnoses not specified so comparisons not made; sample had experience of exercise, this may make the sample less generalisable.	QAT-OC **Weak**
Study 5: Vancampfort et al., 2017	Cross-sectional	48 (24f) adults with psychosis. Over a three-month period, outpatients with clinical diagnoses from	MPAM-R PACE	All motives (both intrinsic and extrinsic) were significantly higher in participants who were exercising regularly (action and maintenance stages) compared	Psychotic symptoms were not measured. Data regarding variable such as length of illness,	QAT-OC **Fair**

		the Butabika National Referral Hospital in Uganda were invited to take part.		to those who were not exercising regularly (pre-action stage). Effect sizes ranges from *d* = 0.68 to *d* = 1.42. It was suggested that extrinsic and intrinsic motives may both be important in physical activity adoption and maintenance. For those in both action stage (<6 months regularly exercising) and maintenance stage (>6 months regularly exercising), fitness was the primary motive for being physically active, followed by interest/enjoyment.	income, education not recorded. No continuous measure of exercise used to explore associations between motives and exercise.	
Study 6: Vancampfort et al., 2016a	Cross-sectional	56(20f) adults with first-episode psychosis. Participants were recruited from 15 psychiatric centres across Belgium.	BREQ-2 PACE	Individuals who were not regularly exercising (pre-preparation and preparation stages) had significantly lower levels of autonomous motivation and higher levels of amotivation that those regularly exercising (>30 mins of moderate intensity exercise most days of the week). Effect sizes ranged from *d* = 0.25 to *d* = 2.32 for autonomous motivation and *d* = 1.14 to *d* = 2.33 for amotivation.	No information on medication use or other lifestyle factors that could be confounding. No continuous measure of exercise.	QAT-OC **Fair**

Study 7: Vancampfort et al., 2016b	Cross-sectional	165(105f) adults with affective disorders. Participants were recruited from 14 centres across Belgium that treat individuals with affective disorders.	BREQ-2 IPAQ PACE	Higher levels of autonomous motivation were observed in individuals who currently exercise (action and maintenance stage) compared to those not exercising (pre-preparation and preparation stages), effect sizes were large, ranging from *d* = 1.16 to *d* = 1.50. Higher levels of external regulation were found for those in the pre-preparation stage compared to those in the maintenance stage (*d* = 0.70) and higher levels of introjected regulation were found in pre-preparation and preparation stages compared to those in the maintenance stage (d = 0.64 and d = .75 respectively)	Majority of sample hospitalised at time of study, which may have impacted exercise participation. No data collected on current state of depressive or manic symptoms or duration of illness.	QAT-OC **Fair**
Study 8: Vancampfort et al., 2015a	Cross-sectional	165(105f) adults with affective disorders. Participants were recruited from 14 centres across Belgium that treat individuals with affective disorders.	BREQ-2 IPAQ	Physical activity was significantly positively associated with autonomous motivation (*r* = .57). Significant negative associations were found between exercise and external regulation (*r* = -.32) and introjected regulation (*r* = -.18). However, external regulation was only significantly negatively associated with	Majority of sample hospitalised at time of study; no data collected on current state of depressive or manic symptoms or duration of illness.	QAT-OC **Fair**

				exercise for individuals with MDD and introjected only significantly negatively associated with exercise for individuals with BD.		
Study 9: Vancampfort et al., 2014	Cross-sectional	129 (44f) adults with schizophrenia. Participants were recruited from 13 centres that treat individuals with schizophrenia across Belgium.	BREQ-2 PACE	Participants regularly exercising (action and maintenance stages) were significantly more autonomously motivated in comparison to those not exercising (preparation and pre-preparation stages), effects were large, ranging from *d* = 0.83-2.30. Participants regularly exercising for more than 6 months (maintenance) also experienced significantly less external regulations that those not considering exercising (pre-preparation), *d* = 0.74.	Majority of sample hospitalised at time of study, may not be generalisable to community settings. No continuous measure of exercise.	QAT-OC **Fair**
Study 10: Vanroy et al., 2017	Experimental: nRCT (2x3 design; between subjects= intervention vs. control; within subjects=	135 (58f) adults with a diagnosed mental disorder (mood/ psychotic/ anxiety). Recruited through 12 centres (e.g. daycare or psychiatric centre) affiliated with the Flemish federation for sports and	LTEQ	An SDT-based intervention did not lead to increased physical activity, decreased symptomology or increased fitness in the intervention group at 6 month follow-up. An increase in physical activity was found for both conditions from before to immediately after the	Lack of randomization and sample size may mean results are confounded by selection bias; differences were found between the two groups on a number of covariates;	QAT-QS **Moderate**

	outcomes at baseline vs. ten weeks vs. six months)	recreation in mental health care. (*n* = 91 SDT intervention group, *n* = 44 control group)		intervention, with a medium effect size across conditions (*d* = 0.60).	there was a fairly high dropout rate.	
Study 11: Cecchini-Estrada et al., 2015	Experimental: RCT (4x3 design; between subjects = SDT intervention vs. alternative intervention vs. active exercise group vs. control; within subjects= outcomes at baseline, vs. eight weeks vs. six months)	106 (68f) university students scoring >29 on scale of depressive symptoms, indicative of significant depression. Recruited from a cohort of university students in Spain. (SDT intervention: *n* = 27, alternative intervention: *n* = 27, active exercise group: *n* = 26, control: *n* = 26)	SIMS IPAQ	SDT-informed intervention for exercise had a significantly positive effect on depressive symptoms with a large effect size (*d* = 1.81), with SDI as a significant and negative predictor of depressive symptoms. Comparatively, effect sizes were below 0.2 for the alternative interventions and active exercise (*d* = 0.09), and control (*d* = 0.12). Long-term effects are considered to be the result of increased exercise, with increase in SDI predicting higher levels of exercise.	Group sample size was small; at-risk as opposed to clinical sample.	QAT-QS **Strong**
Study 12: Chalder et al., 2012	Experimental: RCT (2x4 design; between	361 (239f) adults with depression. Recruited through general practitioners in Bristol and Exeter.	Self-reported exercise	No evidence that SDT-based physical activity intervention improved mood at 4, 8 or 12-month follow-up, in comparison to usual care. However,	Neither researchers nor participants could be blinded due to allocation; overall dropout rate was 29%	QAT-QS **Moderate**

	subjects= intervention vs. control; within subjects = baseline vs. four months vs. eight months vs. 12 months)	(*n* = 182 SDT intervention group, *n* = 179 control group)	participants in SDT-based intervention group reported more physical activity at follow-up periods than those in the usual care group, OR = 2.27 (small-medium effect).

Note. n = number of participants; f = female; SIMS = Situational Motivation Scale; IPAQ = International Physical Activity Questionnaire; BREQ = Behavioural Regulation Exercise Questionnaire; PACE = stage of change questionnaire from the Patient-Centred Assessment and Counselling for Exercise; MPAM-R = Motives for Physical Activity Measure-Revised; BPNES = Basic Psychological Needs in Exercise Scale; PCS = Perceived Competence Scale; TSRQ = Treatment Self-Regulation Questionnaire; LTEQ = Godin-Shephard Leisure-Time Exercise Questionnaire; QAT-QS = Quantitative assessment tool for quantitative studies; QAT-OC = Quality assessment tool for observational cohort and cross-sectional studies. SMI = Severe Mental Illness; MDD = Major Depressive Disorder; BD =bipolar disorder; FEP= first episode psychosis; RCT = Randomised Control Trial; nRCT = non-randomised control trial; IV = independent variable; r = correlation coefficient; d = Cohen's d; OR = Odds Ratio.

Critical Appraisal

Operationalisation of physical activity. Of the 12 included studies, a total of eight studies used self-report measures for exercise such as the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003) and the Godin-Shepard Leisure Time Exercise Questionnaire (LTEQ; Godin, 2011). These studies either used a total metabolic equivalent (MET) score of physical activity or categories of activity such as 'low active', 'moderately active', and 'high active'. Five studies measured exercise using the exercise stages of change measure (Marcus, Selby, Niaura, & Rossi, 1992); all studies using this measure defined exercise as activity of moderate intensity for 30 minutes at least five/most days of the week. Participants were then categorised based on their engagement in physical activity: no exercise, with no intention to start (pre-contemplation); no exercise, but thinking about starting (contemplation); occasionally exercises (preparation); regular exercise starting in the last 6 months (action); regular exercise for more than 6 months (maintenance; Long et al., 1996). This could be considered a crude measure of exercise, relating more to volition than participation, however, it was deemed to meet inclusion criteria and exclusion of this measure would have led to a paucity of studies. Only one of the studies (Farholm et al., 2017b) included an objective measure of exercise, using accelerometers in addition to scores on the IPAQ for a sample of their participants.

Self-determined motivation and physical activity. A total of eight cross-sectional studies explored self-determined motivation for exercise in association with exercise behaviour. The Behavioural Regulation for Exercise Questionnaire (BREQ; Markland & Tobin, 2004) was used in six studies (BREQ-2, n = 5; BREQ-3, n = 1), one study used a scale based on the BREQ and Exercise Self-Regulation

Questionnaire (ESRQ-2), while one study explored exercise regulations using the Treatment Self-Regulation Questionnaire (TSRQ; Levesque et al., 2006). The results of these measures were reported in several ways, including as individual scales, grouped into 'autonomous' and 'controlled' motivation or as a single score of self-determination.

The majority of studies derived a score of 'autonomous motivation', by combining scores from the identified and intrinsic regulation scales; it should be noted that the BREQ-2 does not have a scale for integrated regulation (Markland & Tobin, 2004). The remaining scales were then either examined individually or combined to give a score of 'controlled motivation'.

All studies investigating the relationship between autonomous motivation and exercise as measured by the IPAQ found significant positive relationships, with greater levels of autonomous motivation associated with higher levels of physical activity. Effect sizes ranged from small-medium (r = .21) to large (r = .57). Studies looking at autonomous motivation and exercise stages of change supported this relationship, with levels of autonomous motivation consistently significantly higher in individuals regularly exercising (i.e., those in the action or maintenance stages); effect sizes ranged from small to very large (d = 0.25 to d = 2.32), with the majority showing large effects.

Use of the TSRQ by Farholm et al. (2016b) found that higher levels of integrated regulation were associated with higher levels of physical activity; this supports the other findings that more autonomous motivation is associated with higher levels of physical activity.

Vancampfort et al. (2015a) also calculated a Relative Autonomy Index (RAI), for which scores on each individual regulation scale are weighted and summed to

give a score reflective of a position on the continuum of self-determined motivation (Ryan & Connell, 1989); higher RAI scores are more reflective of greater self-determined motivation. In this study, RAI was found to be significantly positively associated with physical activity levels. Additionally, in accordance with SDT, Farholm et al. (2017a) found that the satisfaction of basic needs was associated with higher levels of autonomous motivation, which in turn was associated with higher levels of exercise; furthermore, a significant indirect relationship was found between need satisfaction and physical activity through autonomous motivation.

Findings were mixed with regards to more controlled regulations. Three studies reported a null association between controlled regulations and exercise (Costa et al., 2018; Farholm et al., 2017a, 2017b). Two studies found support for negative associations between both external and introjected regulations and exercise (Vancampfort et al., 2016b, 2015a). A further study found that only external regulation was significantly higher for individuals not exercising compared to those who had been exercising for more than six months (Vancampfort et al., 2014). These studies found small to medium effects. Furthermore, Vancampfort et al. (2015a) found that introjected regulation was only negatively associated with exercise for those with BD while external regulation was only negatively associated with exercise in MDD.

Additionally, two studies found that amotivation was negatively associated with physical activity in line with SDT (Farholm et al., 2016a; Vancampfort et al., 2016a).

Studies that looked at separate scales of behavioural regulation do not appear to have controlled for the other regulations; therefore, it cannot be concluded that the significant associations are *independently* associated with exercise. However,

overall, the findings from this review support the results of studies that have explored these variables in the general population (Teixeria et al., 2012). Autonomous forms of regulation are positively associated with exercise participation, amotivation is negatively associated with exercise participation, and a negative or null association is found with more controlled forms of regulation, with greater effects for external regulation (Teixeira et al., 2012). These results were found over a range of different diagnoses, including affective disorders, schizophrenia, SMI and psychosis, suggesting that these findings are consistent across clinical populations.

Motives and physical activity. Vancampfort et al. (2017) conducted the only study that explored motives for physical activity; this cross-sectional design used the Motives for Physical Activity Measure Revised (MPAM-R; Ryan et al., 1997). The MPAM-R assesses five motives for exercise, which can be considered intrinsic (interest and competence) and extrinsic (fitness, appearance, social) with regards to SDT. Motives for exercise were explored in relation to exercise stages of change; higher scores across all motives were found for those who were currently physically active (action and maintenance stages). Furthermore, fitness as a motive was found to be the primary motive for exercise, followed by interest/enjoyment, across the stages of exercise. It was concluded that both extrinsic and intrinsic motives have a role in the adoption and maintenance of physical activity. The sample for this study was adults with psychosis: diagnoses included schizophrenia, schizoaffective disorder, BD and depression with psychotic features. However, no comparisons were made between diagnoses. Furthermore, this study was conducted in Uganda; therefore, it is possible that there were socio-cultural differences in this sample that cannot be generalised to other populations. For example, there may be stigma

against being active and slim within this population due to the prevalence of HIV and poverty being associated with a thinner appearance (Vancampfort et al., 2017).

SDT-informed interventions. Three eligible studies used SDT-informed interventions, all using a controlled clinical trial design: two randomised and one non-randomised. One study used a sample of adults with a diagnosed severe mental disorder, such as psychotic and mood disorders (Vanroy et al., 2017), another used adults with a diagnosis of depression (Chalder et al., 2012) and the third used university students with significant depressive symptoms (Cecchini-Estrada et al., 2015). While the main outcome for all three studies was mental health symptoms, exercise was also measured as an outcome in each study. These studies had large sample sizes, with a total of 602 participants across the three studies.

Cecchini-Estrada et al. (2015) used four groups to compare an SDT-informed exercise intervention to alternative exercise interventions and a control; the intervention took place three hours a week for eight weeks and follow-ups were conducted post-intervention at eight weeks and six months later. The SIMS was used to calculate a self-determination index (SDI) score and significant increases in SDI scores were found in the SDT-informed intervention group at the eight-week and six-month follow-up, indicating increased self-determined motivation for exercise. The SDI was a significant negative predictor of depressive symptoms in this group at both time points, with a direct effect at eight weeks and an indirect effect at six months due to participants independently increasing their exercise as measured by the IPAQ. There were no significant differences in SDI scores or exercise at either time points for the alternative groups.

Chalder et al. (2012) conducted the longest trial within these intervention studies, in which adults with depression in the intervention group were offered three face-to-face sessions and 10 telephone calls by a trained facilitator over a period of eight months in addition to treatment as usual (TAU); symptoms of depression and physical activity were measured at four, eight and 12 months. Results were compared to a control group who received TAU. While no differences in symptoms were found at any time point between the two groups, the intervention group showed a significant increase in participation in physical activity over the follow-ups, demonstrating a lasting effect of the intervention on physical activity levels. It should be noted that although SDT-informed, no measures of SDT-related constructs were used; therefore, it may be that the increase in long-term exercise participation may have occurred for reasons nonspecific to SDT.

Vanroy et al. (2017) compared a 10-week SDT-informed walking intervention to a control group receiving no specific exercise intervention, in a sample of individuals with diagnosed mental disorders. Exercise levels were measured using the LTEQ at 10 weeks and six months. In contrast to the other intervention studies, exercise participation was found to significantly increase across both conditions at the 10-week mark and no lasting effects were found at the six-month follow-up. It was suggested that involvement in an exercise study with measures of exercise may have been the reason for short-term increase in exercise across both conditions (Vanroy et al., 2017). Absence of the hypothesised effects was suggested to be due to the lack of intensity of the exercise intervention as this was a walking intervention. Alternatively, a lack of long-term change in exercise participation could have been due to the intervention itself not leading to a change in self-determined motivation for

exercise. However, as self-determined motivation for exercise was not measured in this instance, this remains speculative.

The latter two intervention studies, although SDT-informed, did not measure any SDT-related constructs. Having such a measure could have been helpful in exploring whether the SDT-informed interventions resulted in changes to self-determined motivation within individuals. It should also be noted that the samples in the first two intervention studies were experiencing depressive symptoms and results may not be generalisable to individuals with SMI. Overall these intervention studies suggest that SDT-informed interventions have the potential to lead to an increase in exercise participation and adherence in both the short- and long-term.

Discussion

This paper aimed to review the literature examining relationships between constructs of self-determination theory and exercise participation in SMI and affective disorders. Of the studies eligible for this review, 75% were published after 2015, highlighting the recent interest and exploration within this area.

The majority of the eligible studies explored the relationship between behavioural regulation and exercise. Results consistently indicated that more autonomous forms of motivation were significantly associated with physical activity, whether assessed across separate scales, composite scores or autonomous motivation as a combined scale. These results are similar to findings across the general population and support the idea that motivational processes for exercise are similar regardless of population (Teixeira et al., 2012). However, research that has examined separate scales of self-determined motivation in non-clinical samples has found stronger associations between identified and integrated regulation and

exercise in comparison to intrinsic regulation (Teixeira et al., 2012). There were not enough studies within this review examining separate scales to corroborate these findings in clinical populations. This may be helpful to explore in more detail in the future as different types of autonomous motivation would be promoted in different ways; for example, targeting congruence with an individual's values rather than targeting enjoyment of exercise itself.

The findings from this review that amotivation tends to be negatively associated with exercise and controlled forms of motivation tend to have a negative or null association with exercise have also been found in the wider literature (Teixeira et al., 2012). However, what is not explored in the included studies is whether clinical populations are more likely to experience motivation for exercise of a poorer *quality* than the general population. Therefore, they do not answer the question of whether poor exercise participation in these populations is the result of the quality of motivation they hold.

The findings in the general population with regards to motives for exercise suggest that there is a positive association between more intrinsic motives and exercise (Teixeira et al., 2012); there have been mixed results with more extrinsic motives, predominantly finding no association (e.g., Ryan et al., 1997) or a positive association (e.g., Frederick & Ryan, 1993). The drawn conclusion is that both intrinsic and extrinsic motives can have value in promoting exercise; however, this may be due to regulations and motives being empirically crossed, such that one still holds more autonomous forms of motivation as well as more extrinsic motives (Teixeira et al., 2012). In this review, the one study addressing motives for exercise in a clinical population found that both intrinsic and extrinsic motives were significantly associated with exercise (Vancampfort et al., 2017). While this appears

to fit with results in the general population, the lack of relevant studies means that it is not possible to generalise these findings to further clinical samples. Furthermore, it is not possible to determine whether motives and behavioural regulation are independently associated with exercise.

All of the included cross-sectional studies used subjective measures of physical activity; while this is a common method for assessing exercise, particularly in large samples, these measures are less valid and can be subject to individual interpretation and memory biases (Vanhees et al., 2005). However, some self-report measures such as the IPAQ have been validated against objective measures such as accelerometers that have in turn shown moderate criterion validity (Craig et al., 2003).

Three studies in this review used experimental designs and as would be expected, the interventions varied in length, intensity, procedure and target populations. Two studies demonstrated the benefit of an SDT-informed intervention in increasing and maintaining exercise behaviour. However, the samples in both of these studies had depressive symptoms. Further experimental studies are required to explore the effectiveness of SDT-informed interventions on exercise participation in SMI. Furthermore, while all studies measured physical activity as an outcome, only one of these three studies assessed any changes in self-determination. More experimental studies within clinical samples would be required to explore changes in motivational processes over time in these populations.

Overall, the results from this review provide support for SDT and highlight the importance of autonomous motivation in adopting and sustaining exercise behaviour. In line with SDT, this suggests that satisfying the basic psychological needs of

autonomy, relatedness and competence is integral in fostering autonomous motivation to facilitate this behaviour (Deci & Ryan, 2000).

Limitations

A number of limitations to the studies reviewed should be acknowledged. Firstly, 75% of the eligible studies used a cross-sectional design; while these can provide valuable insight into relationships between variables that can inform future intervention research, it is not possible to ascertain the directionality of the relationships at this stage. It is also possible that confounding variables would be responsible for the associations found. Furthermore, the majority of the reviewed studies examined the relationship between behavioural regulation and exercise, with only one study exploring motives. While the latter study may not be generalisable, overall, this review provides support for consistency in findings between SDT constructs and exercise across populations. This suggests that findings from general populations may be drawn on to inform motivational processes in clinical populations (Teixeria et al., 2012). In this way, it may be possible that similar interventions can be used across populations.

However, no studies directly compared these motivational processes between individuals with and without SMI or affective disorder; therefore, it is not possible to determine the extent to which processes are comparable. With the processes deemed to be similar, the disparity in exercise behaviour between clinical and non-clinical populations may be due to the *quality* of motivation. However, lack of comparative studies means that it is not possible to be definitive.

Additionally, five of the eligible studies came from the same lead author, thus there may be an allegiance bias in the literature (Leykin & DeRubeis, 2009).

Although these studies considered a range of clinical presentations across different settings and in some cases different countries, it is important to note that similar methodological approaches could make the wider findings less generalisable.

With regards to limitations of the review itself, studies were not included unless published in a peer-reviewed journal; this meant that unpublished research and grey literature was not included. While this is not uncommon for systematic reviews, it may mean that this review is susceptible to publication bias given that significant findings are more likely to be published (Easterbrook, Gopalan, Berlin, & Matthews, 1991). However, research has found that unpublished/grey literature often make up a small proportion of included studies and rarely impact the results (Hartling et al., 2017). Nevertheless, future research could do a meta-analysis and use a funnel plot to get a sense of the extent to which this is a problem.

Future Research

Future research in this area would benefit from the use of more experimental and longitudinal designs to better understand the processes of motivation and their impact on exercise behaviours in these clinical populations. This may be particularly important in samples with SMI and affective disorders as eligible intervention studies in this review predominantly used samples with depressive symptoms. Research looking at SDT constructs and exercise within clinical populations would also benefit from examining individual scales of behavioural regulation; this may help to determine the nature of their role and how to target interventions in response to specific types of regulations. Furthermore, research comparing motivation for exercise in clinical and non-clinical populations is lacking; this would provide a direct test of whether processes are significantly different between populations. It would

also help illuminate whether it is comparatively poor *quality* of motivation that explains low rates of exercise in clinical populations.

Conclusions

This paper reviewed literature examining the relationships between the constructs of self-determination theory and exercise participation for individuals with SMI and affective disorders. The review adopted the PRISMA-P approach to protocol development (Moher et al., 2015), and a total of 12 independent studies were deemed eligible for inclusion. Findings supported the relationship between more autonomous forms of motivation and exercise participation across different clinical diagnoses and settings. The findings in this study are consistent with findings in the general population, suggesting that SDT is a useful framework to understand motivational processes across populations. Furthermore, previous research may also be generalisable to clinical populations and be useful in promoting exercise in this predominantly sedentary population. It is suggested that further intervention and longitudinal studies are required to explore changes in motivational processes and exercise participation specifically within clinical populations.

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Appendix A: Preparation and Submission Requirements for Mental Health and Physical Activity (MENPA)

Mental Health and Physical Activity is an international journal looking to advance the understanding of the relationship between mental health and physical activity. Manuscripts which deal with high quality research, comprehensive research reviews, and critical reflection of applied or research issues will be considered for publication.

Preparation

Cover letter. The cover letter accompanying the manuscript submission must include all authors' names and affiliations to avoid potential conflicts of interest in the review process. An address, phone number, email address and fax number should be provided for the corresponding author for possible use by the editorial office and later by the production department. The cover letter should indicate any potential conflicts of interest (e.g., commercial sponsorship). The source of any funding that may have contributed to the production of the research and/or manuscript should be declared in the cover letter, and if the manuscript is accepted for publication, as an acknowledgement in the published paper.

General. Manuscripts should be prepared following the general style guidelines described in the Publication Manual of the American Psychological Association (Latest Edition). Do not import the Figures or Tables into your text. The Editors reserve the right to adjust style to certain standards of uniformity.

Paper length. All manuscripts should be presented as concisely as possible, and our preference is to receive manuscripts that are 30 A4, double spaced pages or less (APA format), including text, references, figures, and tables. For longer

manuscript, authors should contact an Editor in Chief prior to submission with a clear justification for the need for a longer manuscript. Short Communications are also accepted and encouraged. These are typically no more than 15 A4, double spaced pages (APA format). Occasionally other forms of submission may be of interest to the Editors/readers such as book reviews, commentaries, and news items.

This journal uses double-blind review, which means the identities of the authors are concealed from the reviewers, and vice versa. More information is available on our website. To facilitate this, please include the following separately: Title page (with author details): This should include the title, authors' names, affiliations, acknowledgements and any Declaration of Interest statement, and a complete address for the corresponding author including an e-mail address. Blinded manuscript (no author details): The main body of the paper (including the references, figures, tables and any acknowledgements) should not include any identifying information, such as the authors' names or affiliations.

Title Page

- The title should be concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
- Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. You can add your name between parentheses in your own script behind the English transliteration.
- Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lowercase superscript letter immediately after the author's name and in front of the appropriate address.

Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.

- Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. This responsibility includes answering any future queries about Methodology and Materials. Ensure that the e-mail address is given and that contact details are kept up to date by the corresponding author.
- If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Abstract

Abstract Papers should include an abstract, not exceeding 250 words, covering the main factual points and statement of problem, method, results and conclusions.

Highlights

Highlights are mandatory for this journal. They consist of a short collection of bullet points that convey the core findings of the article and should be submitted in a separate editable file in the online submission system.

Keywords

Authors are requested to supply a maximum of 6 keywords accurately describing the contents of the manuscript. These are normally not words used in the title.

Tables

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Referencing

References should be prepared using the Publication Manual of the American Psychological Association (6th Edition) for style.

SCHOOL OF PSYCHOLOGY

DOCTORATE IN CLINICAL PSYCHOLOGY

EMPIRICAL PAPER

An exploration of the associations between hypomanic traits, motives and exercise in the context of self-determination theory

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Abstract

***Objective**:* The current study aimed to explore associations between hypomanic personality traits, over-ambitious life goals, exercise motives, behavioural regulation and exercise behaviour. It was hypothesised that hypomanic traits would be significantly associated with setting more overly-ambitious life goals and extrinsic motives for exercise; these were derived from the theoretical perspectives of Self-Determination Theory (Deci & Ryan, 2000) and research into goal dysregulation in Bipolar Disorders (Johnson, 2005).

***Method**:* A sample of 165 undergraduate students (83% female [*n* = 133]; age, *M* = 19.3 years old, *SD* = 0.4, range 18-40) was recruited from the University of Exeter to take part in this longitudinal study. Participants completed a selection of self-report questionnaires measuring variables including hypomanic personality traits, over-ambitious goal setting, motives for exercise, behavioural regulation and exercise behaviour via an online survey. Exercise behaviour was then captured a week later in a follow-up survey.

***Results**:* Mediation analyses revealed an indirect effect of hypomanic traits on exercise motives via overly-ambitious goal setting. No significant relationships were found between hypomanic traits and exercise behaviour itself and further mediation analyses revealed no effect of exercise motives on exercise behaviour through behavioural regulations.

***Conclusions**:* Findings from this study provided mixed support for the proposed hypotheses; despite no significant associations between hypomanic traits and exercise behaviour itself, hypomanic traits appear to make a unique contribution to exercise motives, via over-ambitious goal setting. Therefore, they may play a role in

the motivational processes that have consistently shown to be associated with exercise engagement and adherence (Ingledew & Markland, 2008, Teixeira et al., 2012). Exploring these variables within a clinical population may be a useful next step in further understanding these motivational processes.

Keywords: self-determination theory; motives; behavioural regulation; bipolar disorder; physical activity; extrinsic goals.

Introduction

Background

Bipolar Disorders (BD) are chronic and enduring mental illnesses, typically involving episodes of depressed mood and episodes of mania or hypomania; these are often severe enough to interfere with daily functioning and cause high levels of distress (McCormick, Murray, & McNew, 2015; Miller, 2006). BD are also associated with high rates of physical health problems and mortality, primarily due to general medical disorders, such as cardiovascular and respiratory diseases, obesity and diabetes (Correll, Detraux, De Lepeleire, & De Hert, 2015; Roshanaei-Moghaddam & Katon, 2009). Compared to the general population, mortality rate is two to three times higher for people with severe mental illnesses (SMI), including BD, and the most common cause of death is physical illness (Crump, Sundquist, Winkleby, & Sundquist, 2013; Hayes, Miles, Walters, King, & Osborn, 2015). Explanations include adverse effects from pharmacological treatment and biological factors but also unhealthy lifestyle factors, which are potentially modifiable (Roshanaei-Moghaddam & Katon, 2009).

Exercise[1] is therefore one of the key recommendations as a modifiable lifestyle change in the longer term treatment of BD, sitting alongside pharmacological and psychological interventions (NICE, 2006). However, research suggests that adults with BD often lead a sedentary lifestyle (Janney et al., 2014); therefore, it is vital not only to make recommendations for lifestyle changes, but to explore how to implement and sustain these practices in order to promote health and well-being (Crump et al., 2013). In recent years, research into BD and exercise has increased

[1] Exercise is operationalised as any purposeful physical activity that improves or maintains overall health, fitness, and/or well-being; in the current study, the terms physical activity and exercise are used indiscriminately (Teixeira et al., 2012).

as researchers attempt to understand the factors that influence participation and long term adherence to exercise programs within this population (Vancampfort et al., 2016b).

Several barriers to exercise participation have been identified in clinical populations, including lack of support, psychosomatic symptoms, physical co-morbidities and motivation (Firth et al., 2016). Motivation for exercise has repeatedly been found to be associated with engagement in exercise in individuals with SMI and affective disorders (Farholm, Sorensen, & Halvari, 2017a; Happell, Platania-Phung, & Scott, 2013; Teixeira, Carraca, Markland, Silva, & Ryan, 2012).

Self-Determination Theory (SDT; Ryan & Deci, 2000) is a prominent theory of motivation that is frequently used as a framework to understand motivational processes within different populations and contexts, including sport and exercise (Frederick & Ryan, 1993; Teixeira et al., 2012). SDT considers there to be qualitatively different types of motivation that regulate human behaviour, which are experienced on a continuum of self-determination (Deci & Ryan, 2000; Vancampfort, Stubbs, Venigalla, & Probst, 2015b). SDT arises from a humanistic perspective, and focuses on the fulfilment of three basic needs as integral for well-being and psychological growth; these are autonomy, relatedness and competence. It is argued that satisfaction of those basic needs will enhance self-determined motivation while thwarting those needs can undermine self-determined motivation (Ryan & Deci, 2000). The continuum of self-determination is shown in Figure 1, illustrating the different types of motivation as defined by SDT and the regulatory processes they encompass; the descriptions that follow consider these in the context of exercise.

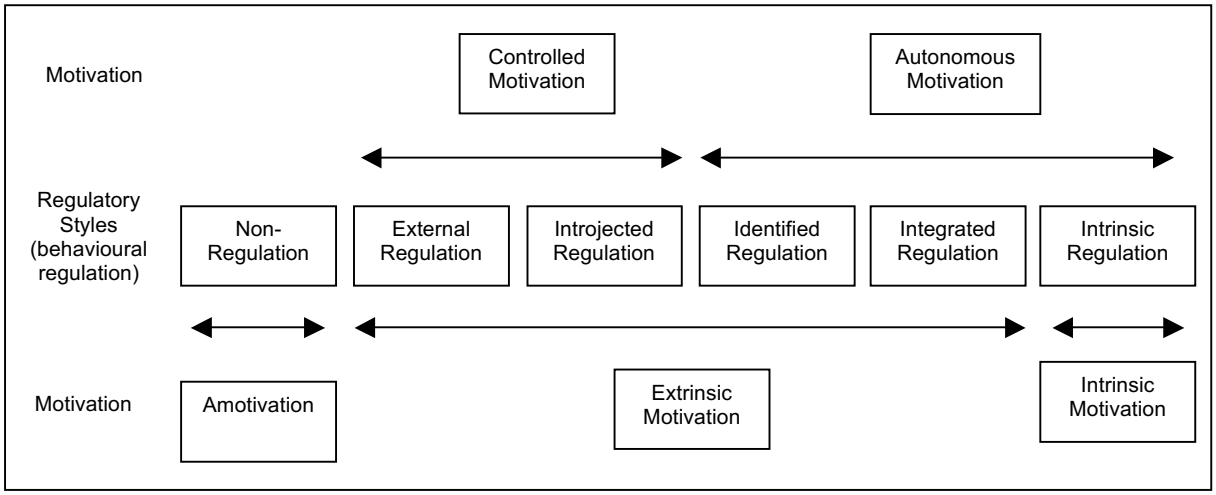

Figure 1. An illustration of the continuum of self-determined motivation, adapted from Ryan and Deci (2000).

Firstly, SDT differentiates between intrinsic and extrinsic motivation (Ryan & Deci, 2000). Intrinsic motivation involves engaging in exercise for the sake of that activity, through enjoyment, interest or challenge (Vancampfort et al., 2015a). Extrinsic motivation refers to exercising for reasons that are separate to the exercise itself; SDT considers there to be four different types of extrinsic motivation, varying in the degree to which their regulation is self-determined (Deci & Ryan, 2000). Integrated regulation is the most self-determined form of extrinsic motivation, this is where exercising is congruent with an individual's sense of self (Deci & Ryan, 2000). Identified regulation is the next highest in self-determination, where an individual may value exercise as being personally important but not necessarily enjoy the exercise itself (Teixeira et al., 2012). Intrinsic, integrated and identified regulation are referred to as *autonomous* motivation, which has consistently been found to be associated with self-reported exercise; more specifically, identified regulation has been found to be more predictive of initial participation in exercise and intrinsic motivation predictive of long-term adherence (Teixeira, 2012). It is argued that

engaging in exercise in environments that satisfy the basic psychological needs of autonomy, relatedness and competence facilitates more autonomous motivation (Teixeira et al., 2012).

Less self-determined forms of extrinsic motivation include introjected and external regulations; introjected regulation refers to exercise driven by self-approval, guilt or self-criticism (Deci & Ryan, 2000). External regulation is considered the least self-determined form of extrinsic motivation and refers to engaging in physical activity to avoid punishment or obtain a reward; together, external and introjected regulations are known as *controlled* motivation (Teixeira et al., 2012). Within the general population, controlled motivation has been found sometimes to regulate short term but not long term behaviour (Deci & Ryan, 2000). Engaging in exercise in environments that thwart the satisfaction of basic needs likely leads to more controlled forms of motivation (Teixeira et al., 2012). Finally, amotivation is defined as no intention to engage in exercise and is considered an absence of motivation (Teixeira et al., 2012).

These concepts have been explored within the general population since the 1980s, but only recently has research into motivation for exercise been explored in psychiatric populations (Farholm & Sorensen, 2016a, 2016b; Verhaeghe, DeMaeseneer, Maes, VanHeeringen, & Annemans, 2013). The emerging evidence suggests that motivational processes in these populations do not differ from the general population, with autonomous motivation positively associated with exercise in individuals with SMI and affective disorders (Vancampfort et al., 2015a; Farholm, Sorensen, Halvari, & Hynnekleiv, 2017b).

Findings have been more mixed with regards to more controlled forms of motivation. Some research has found no association between controlled forms of

motivation and exercise in psychiatric populations, while some has found negative associations. Vancampfort et al. (2015a) found that introjected regulation was significantly negatively associated with exercise for individuals specifically with BD, but no association was found with external regulation. Vancampfort et al. (2016c) also observed that there were higher levels of introjected regulation in individuals with affective disorders preparing to initiate an exercise routine compared to those maintaining an exercise routine. It may be that individuals in this population are motivated by the desire to avoid self-reproach when pursuing goals in exercise (Vancampfort et al., 2016c).

Within SDT, behavioural regulations are considered the 'why' of goal pursuits; these are the reasons why individuals engage in exercise behaviour. These are differentiated from 'motives'[2], which are considered the 'what' of goal pursuits, that is the specific outcomes they are pursuing by engaging in that behaviour (Deci & Ryan, 2000; Sheldon, Ryan, Deci, & Kasser, 2004).

Within SDT, motives are also distinguished as intrinsic and extrinsic, in line with the extent to which basic psychological needs will be satisfied in their pursuit (Teixeira et al., 2012). Examples of intrinsic motives for exercise would be enjoyment or positive health; these are related to the fulfilment of the basic psychological needs. Conversely, examples of extrinsic motives would be physical appearance or social recognition (i.e., goals that relate to outcomes outside of the individual), which do not serve to satisfy basic psychological needs (Sheldon et al., 2004). An individual could hold a number of different motives towards exercise, including both intrinsic and extrinsic motives; it is suggested that a greater prevalence of intrinsic motives over extrinsic motives or vice versa will determine outcomes that are

[2] Here, the term *motive* is used to refer to goal contents. Some research has used the term *motive* to describe behavioural regulation; however, this study uses it in accordance with traditional motivation psychology and pertinent research (Ingledew & Markland, 2008).

favourable or otherwise (Sebire, Standage, & Vansteenkiste, 2009). While motives and behavioural regulations can be empirically crossed, research indicates that extrinsic motives tend to be associated with controlled regulations and intrinsic motives with autonomous regulations and in turn, greater well-being (Deci & Ryan, 2000; Ingledew & Markland, 2008; Sheldon et al., 2004). Ingledew and Markland (2008) more specifically found that identified regulation was predicted by health/fitness motives, introjected regulation was predicted by appearance/weight motives and external regulation by social recognition and appearance/weight motives.

Within the general population, studies have found positive associations between intrinsic motives and exercise behaviour and no association or negative associations between extrinsic motives and exercise behaviour (Ingledew & Markland, 2008; Ingledew, Markland, & Ferguson, 2009). Furthermore, some research has found evidence for mediating relationships between exercise motives, behavioural regulation, and exercise behaviour (Duncan et al., 2015; Gillison, Standage & Skevington, 2006; Ingledew & Markland, 2008; Sibley & Bergman, 2016). Ingledew and Markland (2008) found that health and fitness motives had a significant indirect effect on exercise participation via identified regulation. Gillison et al. (2006) found that self-determined motivation partially mediated the relationship between exercise motives and exercise behaviour, with intrinsic motives having a significant positive indirect effect and extrinsic motives having a significant negative indirect effect on exercise. In contrast, Duncan et al. (2015) found that the associations of both intrinsic and extrinsic motives with exercise were mediated by autonomous motivation. Additionally, Duncan et al. (2015) highlighted the dearth of

longitudinal studies investigating motives and behavioural regulation in exercise, with many studies being cross-sectional by design.

To date, few studies have examined motives for exercise in psychiatric populations. Vancampfort et al. (2017) examined motives for exercise in a sample of individuals with diagnoses of psychotic disorders, including BD; improving fitness, followed by enjoyment, were deemed the most important motives for exercise in this sample (Vancampfort et al., 2017). Furthermore, Firth et al. (2016) conducted a meta-analysis of motivating factors towards exercise in SMI and found common motives to be losing weight, improving mood and reducing stress.

With research indicating the importance of understanding both the 'what' and 'why' of motivational processes, it appears essential to continue exploring both constructs within psychiatric populations in order to understand how to promote exercise participation for these individuals.

The study of exercise motives may be particularly salient in individuals with BD, as BD is related to elevated reward sensitivity; this becomes evident through over-ambitious goal setting and goal striving even when euthymic (Johnson, 2005; Johnson & Carver, 2006; Johnson et al., 2012). High levels of extrinsic goal setting have been found in individuals scoring highly on the hypomanic personality scale (HPS; Eckblad & Chapman, 1986), a measure to capture stable hypomanic traits (Johnson, 2005; Johnson et al., 2009); these have especially been found in extrinsic domains such as fame, wealth and political influence (Johnson & Carver, 2006).

This tendency to engage in excessive goal setting or goal striving can be explained by a hyperactive Behavioural Activation System (BAS; Depue & Iacono, 1989; Johnson et al., 2012), a biological system that facilitates motivational and cognitive processes in the pursuit of goals. When faced with an incentive stimulus,

the BAS is believed to trigger outputs such as positive affect, goal pursuit, goal setting and excitement (Johnson et al., 2012; Meyer, Johnson & Winters, 2001). Individuals with BD or hypomanic traits have been found to have heightened BAS sensitivity; this is relatively stable, not fluctuating with mania (Johnson et al., 2012).

With a tendency to set over-ambitious extrinsic life goals, it may follow that individuals with BD may also set extrinsic exercise motives. This has been found to be the case in non-clinical samples. For example, Ingledew et al. (2009) found that extrinsic life goals such as fame and image predicted extrinsic exercise motives such as social recognition and appearance/weight, while intrinsic life goals such as relationships and growth, predicted intrinsic exercise motives such as affiliation and challenge. Given that there is evidence for similar motivational processes across different populations, it may hold true that there are similar findings in clinical samples (Teixeira et al., 2012).

With research indicating that hypomanic personality traits are associated with over-ambitious extrinsic life goals (Johnson & Carver, 2006) and life goals predict exercise motives (Ingledew et al., 2009), it is possible to speculate that hypomanic traits may have an indirect effect on exercise motives via over-ambitious life goals. However, to date, exercise motives and their relationships with life goals and exercise behaviour have not yet been explored in relation to hypomanic traits.

This study uses a longitudinal design to explore associations between hypomanic traits, life goals, exercise motives, behavioural regulation and exercise behaviour. Based on previous studies of goal setting in BD and contemporary theoretical perspectives on motivation and exercise, hypomanic traits are proposed to be significantly associated with more extrinsic overly-ambitious life goals, extrinsic exercise motives, more extrinsic forms of behavioural regulation and less exercise

behaviour both cross-sectionally and prospectively. Figure 2 illustrates how the measured variables may be related based on the literature and proposed hypotheses.

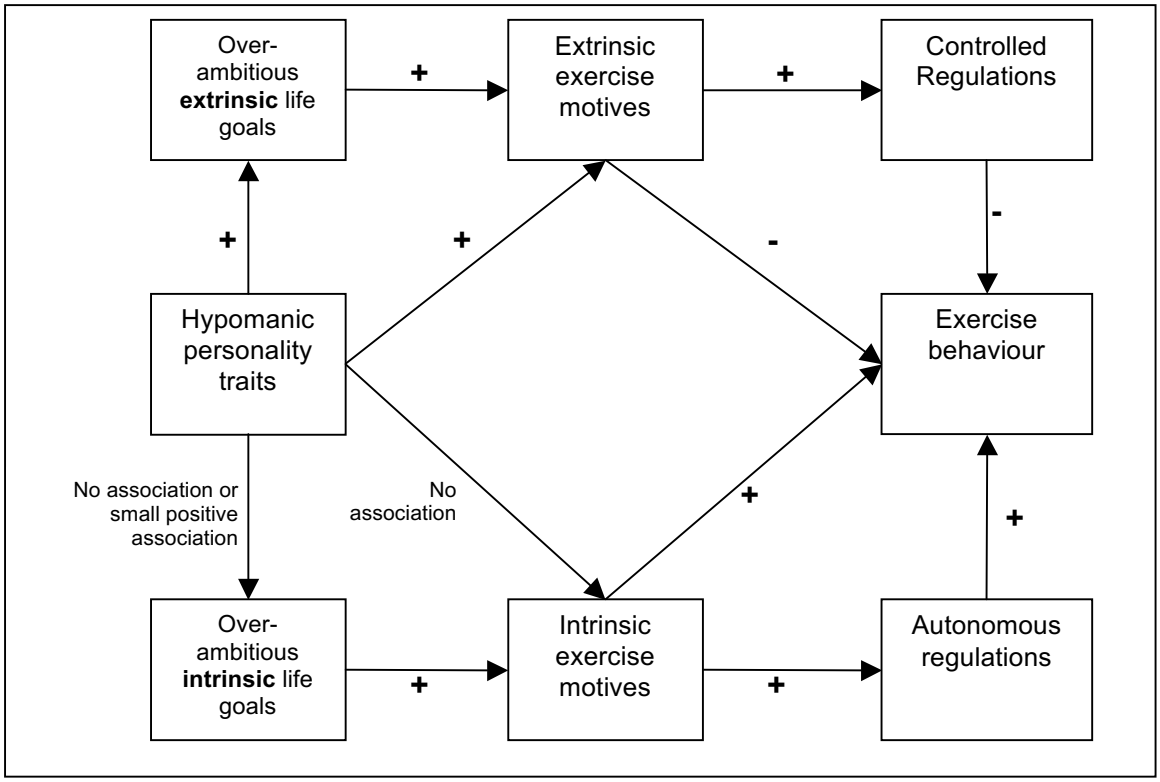

Figure 2. Illustration of how the measured variables may be related based on the proposed hypotheses. Please note that this is not a formal model and will not be tested as such.

Research Questions

1. Are hypomanic personality traits associated with the tendency to set over-ambitious life goals, exercise motives, motivation for exercise and/or exercise behaviour?
2. Are the relationships between hypomanic traits and exercise motives, mediated by the tendency to set over-ambitious life goals?

3. Are previous findings of the relationships between exercise motives, motivation for exercise and exercise behaviour consistent both cross-sectionally and prospectively?

Hypotheses

1. Based on the evidence regarding goal dysregulation in BD and the tendency to set over-ambitious extrinsic life goals (Johnson, 2005), it was predicted that:
    a. Hypomanic traits would be positively associated with overly-ambitious life goals, with a particularly strong association for extrinsic life goals.
    b. Hypomanic traits would be positively associated with extrinsic exercise motives and extrinsic regulations for exercise, notably external and/or introjected regulation.
    c. There would be a null or negative association between hypomanic traits and exercise at both time points.
2. It was predicted that:
    a. Over-ambitious intrinsic life goals would be positively associated with intrinsic exercise motives and over-ambitious extrinsic life goals would be positively correlated with extrinsic exercise motives.
    b. The relationship between hypomanic traits and exercise motives would be mediated by the tendency to set overly-ambitious life goals. More specifically extrinsic exercise motives would be mediated by overly-ambitious extrinsic goals and more intrinsic exercise motives would be mediated by overly-ambitious intrinsic goals.

3. It was predicted that the current study would replicate previous research such that:
    a. There would be positive associations between exercise and identified/intrinsic regulation at both time points.
    b. There would be a negative or no association between exercise and more controlled forms of regulation (external/introjected) at both time points.
    c. The relationship between exercise motives and exercise behaviour would be mediated or partially mediated by behavioural regulation. More specifically, the relationship between more intrinsic (e.g., health/fitness) motives and exercise would be uniquely mediated by identified and/or intrinsic regulation (Ingledew & Markland, 2008). This was expected to occur both cross-sectionally and prospectively.

Method

Design

A longitudinal design was used to explore associations between hypomanic traits, over-ambitious goal setting, exercise motives, behavioural regulation and exercise, with an online survey methodology. Predictor variables were hypomanic personality traits and exercise motives for hypotheses 2 and 3 respectively; outcomes were exercise motives for hypothesis 2 and exercise behaviour for hypothesis 3.

Participants

Opportunity sampling was used to recruit 165 participants from a non-clinical population of undergraduate students from the University of Exeter through the Psychology Research Participation Scheme (83% female [*n* = 133]; age, *M* = 19.3 years old, *SD* = 0.4, range 18-40). Participants were required to be over 18 years of age and fluent in English. Participants were remunerated with course credits or entry into a prize draw for vouchers. From the 165 participants who provided data at baseline, 162 also provided follow-up data, for a retention rate of 98%.

Power Analysis

Using the statistical package G*Power (Faul, Erdfelder, Lang, & Buchner, 2007), it was calculated that for correlation analyses, a sample size of 84 was required to detect a medium effect (*r* = .3), with a power of .8 and alpha level of .05; a medium effect was chosen as a reasonable approximation in the absence of comparable research in the area. The recommended sample size to detect a medium effect with a power of .80 in a bias-corrected bootstrap test of mediation was 71 (Fritz & MacKinnon, 2007). A minimum sample of 84 participants was therefore required in order to achieve sufficient power for all hypotheses.

Measures

Online survey. An online survey was created using LimeSurvey, this computer software was available free of charge via the School of Psychology at the University of Exeter.

Hypomanic Personality Scale (HPS; Eckblad & Chapman, 1986). The HPS (Appendix A) is a 48-item self-report questionnaire designed to capture stable hypomanic traits. It has been found that 78% of individuals scoring highly on the HPS would meet the diagnostic criteria for BD in a 13-year follow up (Kwapil et al., 2000). Studies have previously used the HPS to capture hypomanic traits in undergraduate populations[3] (Johnson & Carver, 2006; Johnson, Carver, Joormann, & Cuccaro, 2015; Mansell, Rigby, Tai, & Lowe, 2008; Schalet, Durbin, & Revelle, 2011). Participants are asked to give a '*true*' or '*false*' response to items such as "I often feel excited and happy for no apparent reason". The HPS has been found to have a high test-retest reliability of .81 and is reported to correlate with other screening measures for mania (Eckblad & Chapman, 1986).

Behavioural Activation Scale (BAS; Carver & White, 1994). The BAS (Appendix B) includes 13 items that measure sensitivity to reward and incentive cues on a four-point Likert scale; it includes three subscales responding to drive, fun-seeking and reward responsiveness. All scales have been reported as having good reliability and construct validity (Alloy et al., 2006; Black et al., 2014; Carver & White, 1994). With a Cronbach's alpha of .83 in the current study, the subscales were combined to give a representative score of trait sensitivity to reward.

The Willingly Approached Set of Statistically Unlikely Pursuits (WASSUP; Johnson & Carver, 2006). The WASSUP (Appendix C) was developed to measure the tendency to set overly-ambitious goals. It contains 30 items, on a 5-point Likert scale from '*no chance I will set this goal for myself*' to '*definitely will set*

[3] As only a small number of participants scored highly on the HPS (n = 1, for scores > 36), an at-risk sample was not targeted and instead associations were explored across all scores on the HPS.

this goal for myself', which relate to seven sub-scales representing both extrinsically and intrinsically oriented goals in different life domains. This measure has been found to have good construct validity (Johnson, Eisner, & Carver, 2009; Johnson & Carver, 2012). To test the proposed hypotheses, subscales conceptualised as extrinsic goals (fame, political influence, and wealth) were grouped into a variable named WASSUP-E and subscales conceptualised as intrinsic goals (family, friends, world well-being and fulfilment) were grouped into a variable named WASSUP-I.

The Behavioural Regulation in Exercise Questionnaire (BREQ-2; Markland & Tobin, 2004). The BREQ-2 (Appendix D) is a widely used 19-item self-report measure looking at motivation in exercise. A 5-point Likert scale ranging from '*not true for me*' to '*very true for me*' is utilised for scales of amotivation, external regulation, introjected regulation, identified regulation and intrinsic regulation. This measure has demonstrated good internal consistencies and construct validity (Markland & Tobin, 2004). The current study used the individual scales of behavioural regulation as a recent meta-analysis has recommended not dichotomising regulations into controlled and autonomous factors; this is due to the positive correlations between introjected (controlled) and identified (autonomous) regulations given their positions on the continuum (Howard, Gagné, & Bureau, 2017).

Exercise Motivations Inventory (EMI-2; Markland & Ingledew, 1997). The EMI-2 (Appendix E) is a self-report measure of intrinsic and extrinsic exercise motives from a SDT perspective; There are 51 items scored on a 5-point Likert-scale from '*not at all true for me*' to '*very true for me*', these items relate to 14 subscales:

affiliation, challenge, enjoyment, appearance, weight management, strength and endurance, nimbleness, stress management, competition, social recognition, health pressures, ill health avoidance, revitalization and positive health. This measure has been found to have good reliability and validity and is applicable to both those who do and do not engage in exercise (Markland & Ingledew, 1997). Ingledew and Markland (2008) found that the enjoyment and revitalisation subscales overlapped with the intrinsic regulation scale on the BREQ-2, therefore these scales were not included, in line with previous research. Ingledew and Markland (2008) grouped together the remaining scales into appearance/weight, social engagement and health/fitness related motives, based on a principal component analysis (PCA). This study took a similar approach, conducting a PCA with oblimin rotation on the subscales of the EMI-2 (Appendix F). Initially the PCA indicated that the challenge and ill health pressures motives cross-loaded on more than one component; with these two subscales removed, the remaining scales loaded independently onto three separate components, which reflected the three components identified by Ingledew and Markland (2008).

However, some of the subscales loading onto the same component were conceptually different at a higher-order level; for example affiliation and social recognition loaded onto the same component. While both interpersonal in nature, exercising for affiliation is intrinsically driven, while social recognition would be considered extrinsic. Therefore, based on the a priori hypotheses regarding intrinsic and extrinsic motives, two subscales were chosen to represent each component that both loaded strongly onto that component and were conceptually similar, i.e., more clearly intrinsic or extrinsic in nature. These were: positive health and strength and endurance (health and fitness [HF] motives), competition and social recognition

(social engagement [SE] motives); weight and appearance (weight and appearance [WA] motives). In this instance, the HF motives would be considered more intrinsic in nature, while SE and WA motives would be considered extrinsic.

International Physical Activity Questionnaire (IPAQ; Craig et al., 2003). Participation in exercise was measured using the short version of the IPAQ (Appendix G), a widely used self-report questionnaire detailing the frequency and intensity of activities (Craig et al., 2003). Participants are asked to record the total minutes of walking, moderate activity and vigorous activity undertaken in the last seven days. A total metabolic equivalent (MET) score per week is calculated as 3.3*walking minutes*walking days + 4.0*moderate activity minutes*moderate activity days + 8.0*vigorous activity minutes*vigorous activity days. This measure has demonstrated good reliability and validity across 12 different countries, with comparable data for both the long and short form (Craig et al., 2003).

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS (Appendix H) is a self-report measure of positive and negative affect. It contains 20 words describing different feelings or emotions, scored on a Likert scale from '*very slightly or not at all'* to '*very much*'. Participants were asked to what extent they had experienced these items in the past week. The PANAS has been shown to be a reliable and valid measure (Crawford & Henry, 2004; Watson et al., 1988).

Follow-up measures. Participants were invited to complete IPAQ-SF and the PANAS a week after completing the initial survey; this was completed online and estimated to take between 5 and 10 minutes.

Procedure

This study was advertised online via the Psychology Research Participation Scheme after ethical approval was granted by the University of Exeter (Appendix I). Individuals interested in taking part contacted the researcher via email and were provided with a web-link to the online survey and a unique ID code. Participants first encountered an information and consent page (Appendix J and K). Participants then proceeded to complete the HPS, BAS, WASSUP, BREQ-2, EMI-2, IPAQ and PANAS, which was estimated to take between 30 and 40 minutes to complete. Participants were able to omit answers they did not wish to give. Participants were then asked to indicate whether they consented to take part in the subsequent survey a week later. Participants who consented were sent the link to the subsequent survey, comprised of the IPAQ and PANAS, the following week. Following completion, participants were directed to the debrief page (Appendix L). Participants who chose to withdraw at any time prior to completion, were also directed to the debrief page.

Analytic Strategy

Normality. Normality of the data was checked by examining histograms, the majority of which were consistent with the assumptions of normality. While some measures, namely the BREQ-2, EMI-2 and IPAQ did appear skewed, parametric tests were selected, in accordance with central limit theorem, given the large sample

size (Ghasemi & Zahediasl, 2012). Non-parametric tests of correlation were also run, which resulted in similar findings (data not reported).

Missing data and data cleaning. There appeared to be no systematic differences between participants who did and did not have missing data. In accordance with the guidelines for data processing and analysis of the IPAQ ("Guidelines for IPAQ short form", 2004), cases with missing data were removed (n = 2), as were cases where time variables exceeded 16 hours (n = 1) as these are considered outliers. Furthermore, as recommended, time variables exceeding 240 minutes were re-coded to '240' to normalize the distribution of activity (n = 2). For all remaining measures, 35 participants (21.6%) were missing at least one item from one of the scales; no cases were missing over 25% of data for any scale within the measures, therefore no further cases were removed and no further outliers were identified. For all remaining scales with missing data, the mean value of items for that subscale were calculated. This method was utilised to maintain the sample size, given the amount of data collected for each individual. A total of 162 cases were included for analysis at baseline.

At follow-up, IPAQ data was missing from one further case and three participants did not provide any follow-up data. Two further cases required recoding a variable to 240 minutes in accordance with guidelines. A total of five participants (3.2%) were missing at least one item on the PANAS, missing item scores were imputed from subscale means as less than 25% of data for each scale was missing. A total of 158 cases were included for analysis at follow-up.

Analysis. Following data cleaning, correlation analyses were conducted to test the first hypothesis that (a) scores on the HPS would be positively associated with scores on the WASSUP, (b) higher HPS scores would be positively associated with extrinsic exercise motives and more extrinsic regulations for exercise and (c) there would be a negative or null association between HPS and exercise behaviour at both baseline and follow-up. Where multiple correlations were conducted to address the same hypothesis, Holm-Bonferroni corrections were used (Holm, 1979).

For the second hypothesis, correlation analyses were used to explore relationships between the WASSUP and exercise motives. Mediation analyses were then used to explore whether the relationship between HPS scores and exercise motives was mediated by the tendency to set overly-ambitious goals. This was conducted using the PROCESS macro for SPSS. A bootstrapping approach with 5,000 resamples was used to derive a 99% confidence interval for the indirect effect of the predictor (HPS score) on the outcome via the mediator (WASSUP). The conservative 99% confidence interval was used to account for multiple testing for the same hypothesis.

For the final hypothesis, correlation analyses were used to explore whether (a) intrinsic and/or identified regulation was positively associated with exercise behaviour, (b) there was a negative or null association between external and/or introjected regulation. Mediation analysis, using the same approach as for hypothesis 2, investigated whether (c) the relationship between exercise motives and exercise behaviour was mediated or partially mediated by behavioural regulation both cross-sectionally and prospectively.

Results

Descriptive statistics are shown in Table 1.

Table 1.

Descriptive statistics for the self-report measures at both baseline (n = 162) and follow-up (n = 158).

Measures	Mean (M)	Standard deviation (SD)	Cronbach's alpha (α)
HPS	16.69	7.85	.86
BAS	25.71	5.22	.83
WASSUP			
WASSUP-E	21.46	4.90	.87
WASSUP-I	50.31	11.32	.87
EMI-2			
HF Motives	3.87	.91	.90
SE Motives	3.47	1.20	.91
WA Motives	1.83	1.32	.92
BREQ-2			
Amotivation	1.40	2.25	.75
External	3.27	3.30	.82
Introjected	5.88	3.23	.80
Identified	10.78	3.65	.82
Intrinsic	10.33	4.22	.92
IPAQ	2656.96	1687.90	-
PANAS			
PAS	30.11	7.41	.87
NAS	22.00	7.73	.87
IPAQ Follow-up	2590.82	1660.83	-
PANAS Follow-up			
PAS	28.47	7.59	.89
NAS	19.96	7.41	.89

While a continuous IPAQ score for exercise was used in the present study, calculating exercise categories for descriptive purposes revealed that 4.2% (*n* = 7) of the sample were considered low active, 58.4% (*n* = 97) were moderately active and

34.9% (*n* = 58) were highly active. A paired samples *t*-test revealed no significant differences between amount of exercise at baseline and follow-up, *t* = 0.62, *p* = .54. Furthermore, while a range of HPS scores were found among the participants (*M* = 16.69, *SD* = 7.85, range 0-37), only one participant scored above 36, scores above which are predictive of elevated risk of mania (Kwapil et al., 2000).

Hypothesis 1

Correlations between key variables are shown in Table 2. Following corrections for multiple testing, HPS scores remained significantly positively related to WASSUP scores with *r* = .30, *p* <.001 for the intrinsic scales and *r* = .35, *p* < .001 for the extrinsic scales as predicted. There was no significant relationship between HPS scores and intrinsic HF motives for exercise, *r* = .09, *p* = .843, HPS scores and extrinsic WA motives for exercise, *r* = .15, *p* = .183 or HPS scores and extrinsic SE motives for exercise, *r* =.16, *p* = .135 following corrections for multiple testing.

No significant relationships were found between HPS scores and any of the extrinsic regulations for exercise scales: external, *r* = .05, *p* = .56; introjected, *r* = .01, *p* =.10; identified, *r* = .08, *p* = .33. There was also no significant relationship between HPS and exercise at baseline, *r* = .09, *p* = .28 or follow-up, *r* = -.12, *p* = .82. These findings are in contrast to the predictions made.

Table 2.

Correlations between key variables for n = 162 for all variables except IPAQ time 2 with n = 158 (before corrections for multiple testing).

Measures		1	2	3a	3b	4a	4b	4c	5a	5b	5c	5d	5e	6	7a	7b
1.HPS	*1.HPS*	-														
2.BAS	*2.BAS*	.48***	-													
3.WASSUP	*3a.WASSUP-I*	.30***	-.47***	-												
	3b.WASSUP-E	.35***	-.31***	.53***	-											
4.EMI-2	*4a.HFMotives*	.09	.33***	.25***	.12	-										
	4b.SEMotives	.16*	.27***	.31***	.39***	.29***	-									
	4c.WAMotives	.15	.20**	.32***	.14	.32***	.24**	-								
5.BREQ-2	*5a.Amotivation*	.11	-.11	.02	.10	-.34***	-.09	-.03	-							
	5b.External	.05	-.04	.14	.14	-.04	.18*	.32***	.30***	-						
	5c.Introjected	.13	.11	.24**	.13	.38***	.28***	.45***	-.21**	.21**	-					
	5d.Identified	.08	.24**	.21**	.14	.53***	.37***	.22**	-.40***	-.06	.68***	-				
	5e.Intrinsic	-.05	.21**	.18*	.12	.51***	.49***	.05	-.37***	-.15	.39***	.76***	-			
6.IPAQ	*6.IPAQ*	.09	.13	.15*	.15	.16*	.34***	.07	-.24**	-.10	.23**	.36***	.41***	-		
7.PANAS	*7a.PAS*	.24**	.44***	.40***	.31***	.35***	.35***	.07	-.15	-.04	.21**	.49***	.50***	.37***	-	
	7b.NAS	.26***	-.01	.16*	.13	.10	.03	.17*	.20*	.31***	.18*	.04	-.13	-.10	-.16*	-
8.IPAQ-t2	*8.IPAQ - t2*	-.02	.07	.11	.05	.08	.29***	.01	-.18*	-.07	.08	.24**	.30***	.31***	-.08	.57***

*Note. *p <.05, **p <.01, ***p <.001. HPS = Hypomanic Personality Scale; BAS = Behavioural Activation Scale; WASSUP = Willingly Approached Set of Statistically Unlikely Pursuits; HFMotives = Health and fitness motives; SEMotives = social engagement motives; WAMotives = weight and appearance motives; IPAQ = International Physical Activity Questionnaire, PAS = positive affect scale; NAS = negative affect scale; IPAQ-t2 = IPAQ time 2.*

Hypothesis 2

As predicted, correlation analyses with Holm-Bonferroni corrections found a significant positive association between the tendency to set over-ambitious extrinsic goals (WASSUP-E) and extrinsic SE motives for exercise, $r = .39$, $p < .001$. Furthermore, no association was found between WASSUP-E and intrinsic HF motives, $r = .12$, $p = .12$. However, no association was found between WASSUP-E and extrinsic WA motives for exercise, $r = .14$, $p = .07$, which is in contrast to predictions in hypothesis 2(a). The tendency to set over-ambitious intrinsic goals (WASSUP-I scales) was significantly positively associated with HF motives as predicted, $r = .25$, $p = .001$. However, in contrast to predictions, the WASSUP-I scales were also significantly positively associated with WA motives, $r = .32$, $p < .001$ and SE motives, $r = .31$, $p < .001$.

Although no significant relationships were found between the HPS and any of the exercise motives once corrected, the significance of the indirect effect via extrinsic and intrinsic WASSUP scales was nevertheless tested using a bootstrapping approach with 5,000 resamples; for a strong mediator, it is possible that there is greater power to detect the indirect effect than to detect the total effect (Hayes & Rockwood, 2017).

Figure 3 illustrates the mediation analyses[4] conducted to explore the indirect effect of HPS on HF motives via both extrinsic and intrinsic scales on the WASSUP. No significant indirect effects were found for either mediator, this is in contrast to the prediction that WASSUP-I would mediate this relationship. Figure 4 illustrates the

[4] Reverse mediations were conducted for all above analyses, with the WASSUP-I and WASSUP-E as outcomes and each motive as a mediator. No significant results were found for reverse mediations, providing support for the direction of the hypothesised relationships.

same mediation with WA motives as the outcome. It was expected that WASSUP-E would mediate the relationship between HPS and WA motives. Conversely, a significant positive indirect effect of HPS scores on WA motives was found with 65.2% of the total effect being mediated via WASSUP-I, with no significant indirect effect via WASSUP-E.

Figure 5 illustrates the same mediation, with SE motives as the outcome. As predicted, there was a significant positive indirect effect of HPS scores on SE motives, with 70.4% of the total effect being mediated by the WASSUP-E. No significant indirect effect was found via WASSUP-I as predicted.

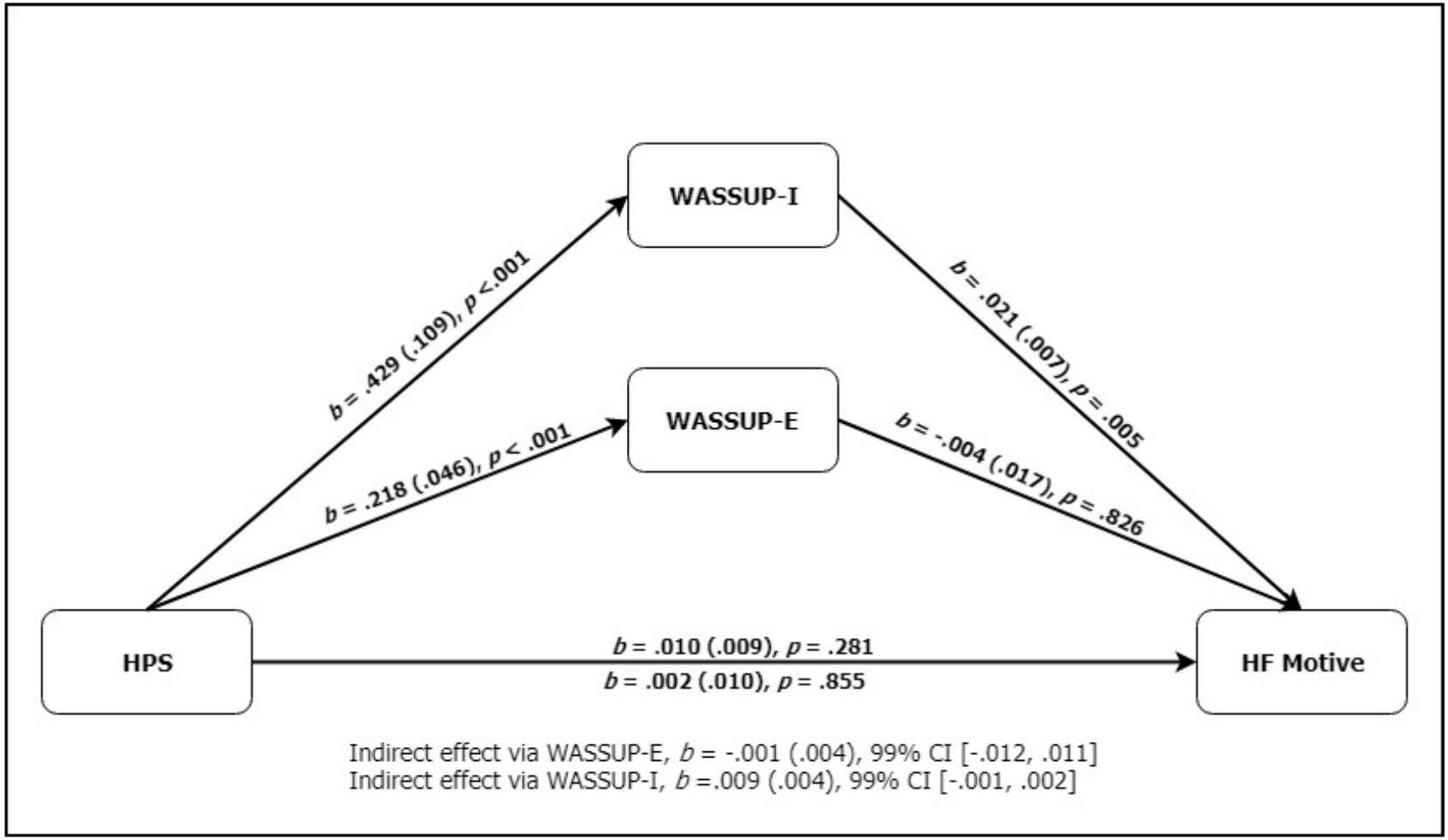

Figure 3. Mediation analyses investigating the indirect effect of HPS on HF motives via WASSUP scales. The unstandardized coefficients on the horizontal axis represent the total effect (above) and direct effect controlling for the WASSUP (below).

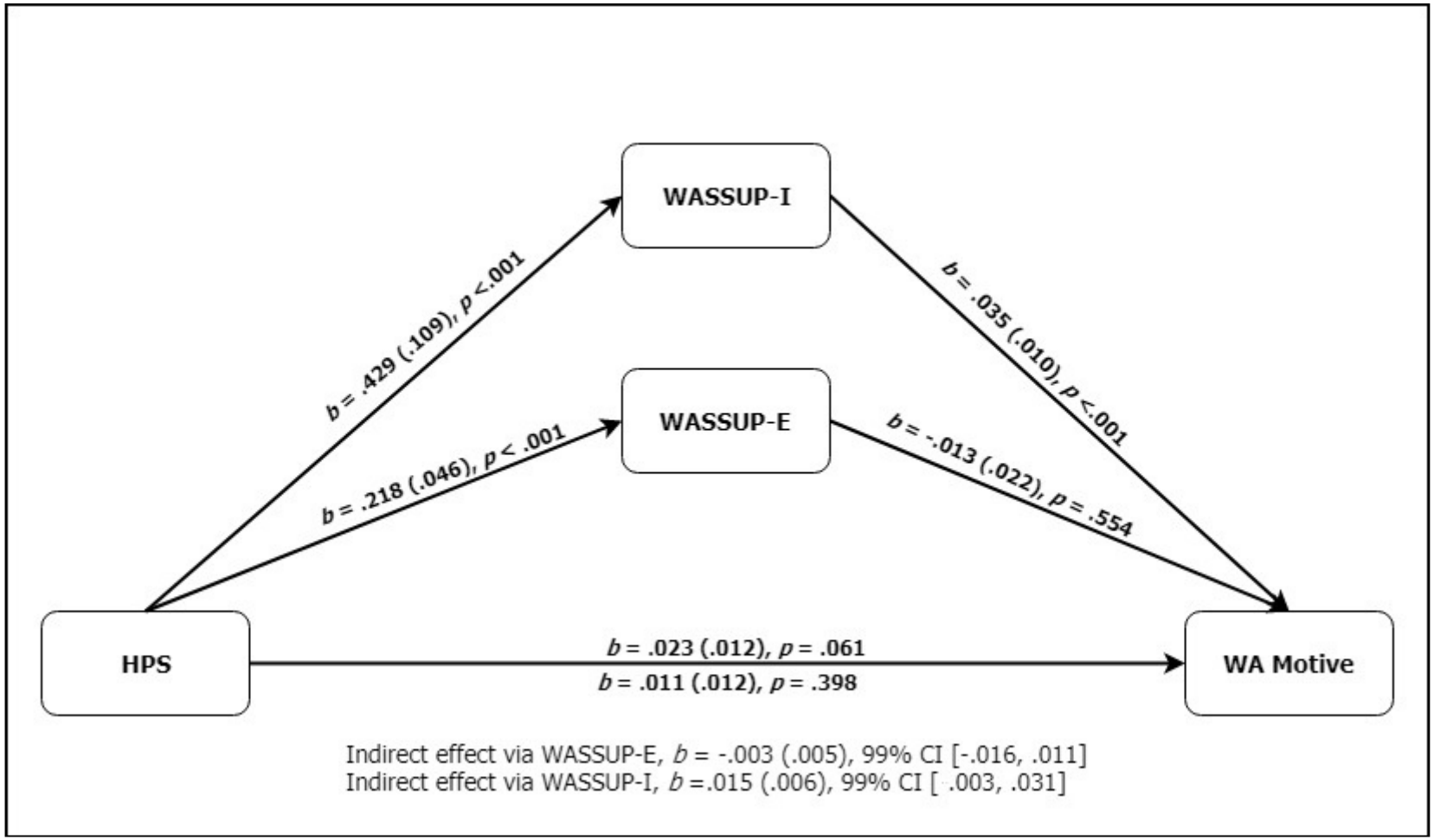

Figure 4. Mediation analyses investigating the indirect effect of HPS on WA motives via WASSUP scales. The unstandardized coefficients on the horizontal axis represent the total effect (above) and direct effect controlling for the WASSUP (below).

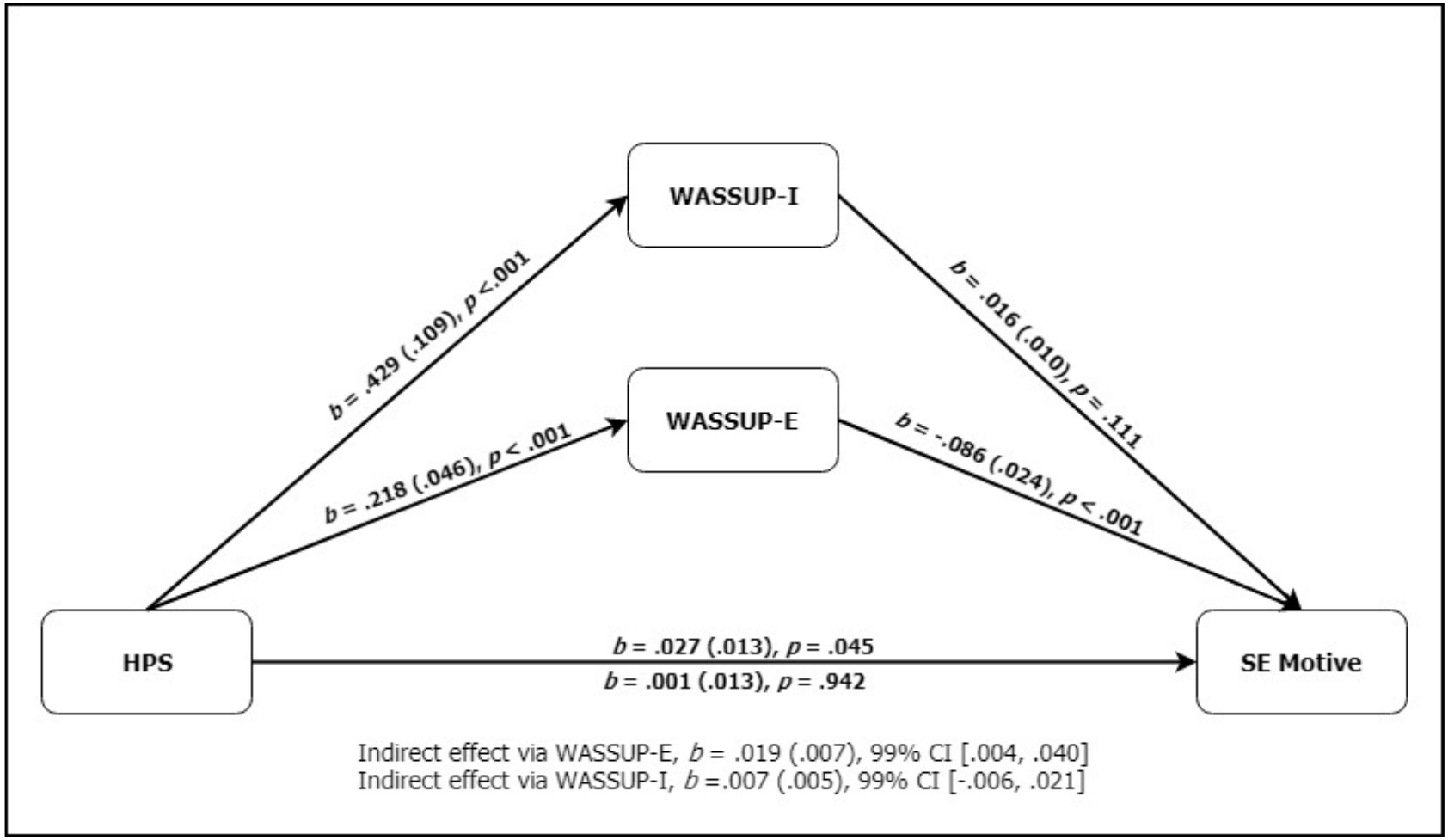

Figure 5. Mediation analyses investigating the indirect effect of HPS on SE motives via WASSUP scales. The unstandardized coefficients on the horizontal axis represent the total effect (above) and direct effect controlling for the WASSUP (below).

Hypothesis 3

Correlation analyses with Holm-Bonferroni corrections found that intrinsic regulation was positively associated with exercise both at baseline, $r = .41$, $p < .001$ and follow-up, $r = .30$, $p < .001$; identified regulation was also positively associated with exercise both at baseline, $r = .38$, $p < .001$, and follow-up, $r = .24$, $p < .001$; these findings support hypothesis 3(a).

No association was found between external regulation and exercise both at baseline, $r = -.10$, $p = .20$, and follow-up, $r = -.07$, $p = .39$. Furthermore, there was no association between introjected regulation and exercise at follow-up, $r = .08$, $p = .30$; these findings support hypothesis 3(b). However, a significant positive association was found between introjected regulation and exercise at baseline, $r = .23$, $p = .006$, which is in contrast to hypothesis 3(b).

Hypothesis 3(c) predicted that the relationship between exercise motives and exercise behaviour would be mediated or partially mediated by behavioural regulation both cross-sectionally and prospectively. In contrast to the predictions made in hypothesis 3(c), no significant indirect effects were detected between any of the exercise motives and exercise at either time point via any of the behavioural regulations (see Appendix M for full results).

Discussion

This study investigated relationships between hypomanic traits, over-ambitious life goals, exercise motives, behavioural regulation, and exercise behaviour within an SDT framework (Deci & Ryan, 2000). This is, to the best knowledge of the researcher, the first study to investigate the associations between these SDT-based variables for exercise and hypomanic traits.

In accordance with hypothesis 1(a), hypomanic traits were significantly positively associated with the tendency to set both intrinsic and extrinsic overly-ambitious life goals; this supports previous research (Gruber & Johnson, 2009; Johnson & Carver, 2006). However, support was not found for hypothesis 1(b) as no association was found between HPS scores and exercise motives following corrections for multiple testing. The lack of significant findings may be due to the subscales used to capture extrinsic and intrinsic exercise motives. In the current sample, 95.8% reported regularly exercising either moderately or vigorously; it may be that these individuals endorse more truly intrinsic motives for exercise, such as challenge and affiliation (Ingledew & Markland, 2008). However, these intrinsic subscales loaded ambiguously across components, so were not included in analysis; instead, health and fitness motives were used to represent more intrinsic motives.

Furthermore, no significant associations were found between hypomanic traits and any forms of regulation for exercise. This is in contrast to the prediction that hypomanic traits would be associated with more extrinsic forms of motivation. While previous research has found quality of motivation to be associated with exercise behaviour in clinical populations (Vancampfort et al., 2015a, 2016c), it may be that hypomanic traits are not associated with motivation for exercise and perhaps other factors in clinical populations influence the types of motivation that regulate behaviour.

Alternatively, it may be that the sample did not have enough of a range of HPS scores to demonstrate any significant findings. While it was anticipated that only a small number would score above the cut-off of 36, the mean score on the HPS did appear lower than other studies that have used the HPS with undergraduate populations (Johnson & Carver, 2006; Johnson et al., 2015; Schalet et al., 2011).The

student sample was recruited due to the exploratory nature of this study, the requirement for a large sample size and in the context of practical limitations of the DClinPsy project. Use of a clinical sample or a non-clinical sample with a larger range of hypomanic traits in future research may reveal more significant relationships.

Hypothesis 1(c) predicted that there would be a null or negative association between hypomanic traits and exercise at both time points. This hypothesis led on from the predicted relationship between HPS and more extrinsic regulations and previous research demonstrating a null or negative association between extrinsic regulations and exercise (Vancampfort et al., 2015a, 2016c). Although no relationship was found between HPS and exercise, it cannot be explained by the presence of more extrinsic regulations. It appears that regardless of the quality of motivation, hypomanic traits do not have a direct bearing on exercise.

There was mixed support for hypothesis 2(a). Extrinsic scales on the WASSUP were associated with extrinsic SE motives for exercise as predicted, however no association was found with the extrinsic WA motives. Previous research has documented an association between manic symptoms in BD and elevated social activity, which may explain the relationships with more social exercise motives (Johnson & Carver, 2006). Furthermore, more intrinsically oriented scales on the WASSUP were positively associated with all exercise motives. This may mean that the tendency to set over-ambitious goals drives a generic response towards a range of exercise motives. Alternatively, these results may be reflective of how effectively the WASSUP captures extrinsic and intrinsic goals as this grouping of subscales has not previously been validated. Previous literature has defined fame, wealth and political influence scales on the WASSUP as clear extrinsic goals (Gruber &

Johnson, 2009; Johnson et al., 2015), however, the other scales, while more intrinsic in nature, may not cleanly capture intrinsic goals and may represent more general over-ambitious goal setting.

There was also mixed support for hypothesis 2(b). Hypomanic traits were found to have an indirect effect on SE motives via extrinsic WASSUP scales as predicted. However, in contrast to predictions, hypomanic traits were found to have an indirect effect on WA motives via *intrinsic* WASSUP scales rather than *extrinsic* scales. Again, it may be that hypomanic traits drive general exercise motives, via more generic over-ambitious goal-setting. Overall, results suggest that over-ambitious life goals in relation to hypomanic traits does appear to uniquely contribute to exercise motives; this appears to fit with predictions derived from theoretical perspectives on SDT and goal-setting in BD (Deci & Ryan, 2000; Johnson et al., 2012). It may be that the HPS indirectly influences exercise behaviour via over-ambitious life goals; however, further research would be required to explore this, perhaps in a clinical sample.

As expected for hypothesis 3, significant positive associations were found between more autonomous (i.e., intrinsic/identified) forms of motivation and exercise at both time points; this is consistent with previous research and the general SDT literature regarding motivation and goal-directed behaviour (Teixeira et al., 2012). A significant positive association was also found between exercise at baseline and introjected regulation. This is in contrast to the predictions made in hypothesis 2(b) and previous research finding a null or negative association with exercise and more controlled regulations (Vancampfort et al., 2015a, 2016c). However, controlled motivation has been found to sometimes regulate short-term but not long-term

behaviour (Deci & Ryan, 2000). It may be that avoidance of self-reproach can drive exercise behaviour in this sample but will not lead to sustained exercise over time.

Again, in contrast to predictions, support for behavioural regulation mediating the relationship between exercise motives and exercise behaviour over time was not found for any type of motive or regulation. These null findings are inconsistent with previous research (Duncan et al., 2015; Gillison et al., 2006) and suggest that behavioural regulation does not influence the relationship between exercise motives and exercise behaviour. Previous research demonstrating significant mediations between these variables grouped scales into autonomous and controlled motivation (Duncan et al., 2015; Gillison et al., 2006). Therefore, the null results in this study may reflect the analysis being run on individual scales of motivation. As regulations are considered to be on a continuum, there are positive correlations between introjected (controlled) and identified (autonomous) regulations, and dichotomising regulations is not recommended (Howard, Gagné, & Bureau, 2017).

While research into motives and behavioural regulation for exercise has increased in recent years, a unique contribution of the current study was the inclusion of hypomanic traits and a measure of overly-ambitious life goals. Overall, this study has found emerging evidence for the indirect role of overly-ambitious life goals in the relationship between hypomanic traits and motives for exercise.

In general, this study provides good support for the use of self-determination theory as a comprehensive theory of motivation applied to exercise. Overall, many of the relationships found between variables provide support for the theorised relationships derived from the literature and proposed hypotheses as indicated in Figure 2; a small number of differences should be noted. Firstly, there was less distinction among the different types of motives, with intrinsic overly-ambitious goal

setting being associated with a more generic drive towards all exercise motives. Secondly, both extrinsic SE motives and introjected (controlled) regulation were positively rather than negatively associated with exercise behaviour. As previously discussed, it may be that these more extrinsic exercise motives and regulations are regulating short but not long-term behaviour (Deci & Ryan, 2000).

Gaining a more comprehensive understanding of the links between motives, behavioural regulation, exercise participation and hypomanic traits could lead to more in-depth investigations at a clinical level for individuals with BD. More specifically, understanding the mechanisms and mediating factors associated with exercise in this population, could lead to the development of interventions, which can be targeted in order to increase sustained adherence to exercise programs within this population.

If the associations between hypomanic traits and over-ambitious life goals found in this study are replicated in a clinical sample, it may follow that over-ambitious goal-setting drives more extrinsic motives for exercise and more controlled forms of regulation. Basic psychological needs may not be fulfilled, which may in turn have detrimental consequences to well-being and may lead to disengagement from that activity in the long-term (Ingledew et al., 2009). It would therefore be helpful to explore these concepts in a clinical sample. Furthermore, building on the current study, it would be valuable for future research to conduct more extensive longitudinal studies with more objective measures of exercise to explore the association between exercise motives and behavioural regulation over time in clinical populations. Conducting experimental work would also be beneficial in further understanding the causal mechanisms behind these motivational processes for exercise within clinical populations.

Limitations

This study had a number of limitations that need to be acknowledged. The sample was predominantly female (83%), with a mean age of 19.3 years; this may limit the generalisability of the results to the general population. It may be that participants who were interested in exercise signed up to this study, as 95.8% reported regularly exercising; this may have accounted for a lack of significant findings around more extrinsic motives and extrinsic regulations for exercise.

Furthermore, while participants provided their age and gender, additional demographic and biological variables such as weight, height and ethnicity were not recorded. It is possible that these additional variables may impact reasons for exercise, for example those with a higher BMI may be more likely to exercise for weight management. However, a recent review of cross-sectional studies exploring motivation for exercise in SMI found that age, gender and BMI has little effect on motivation for exercise (Farholm & Sorensen, 2016a).

While this study has utilised a range of valid and reliable measures to capture the variables of interest, these measures have been self-report in nature, relying on individuals having insight into their motives for exercise; they may also be subject to social desirability, interpretation and/or memory biases. Additionally, individuals with a more ‘extreme response style’ could have endorsed more extreme items across measures, resulting in indirect effects that may not be specific to the underlying constructs (Weijters, Geuens, & Schillewaert, 2010).

Many of the hypotheses were tested using data at one time-point, being cross-sectional in nature means that it is not possible to infer causality. Furthermore, the longitudinal aspect of this study was conducted over a very short period of time due to the time limitations and scope of the DClinPsy project. However, in this case,

the longitudinal aspect was included to add robustness to the mediation analyses and was not exploring change over time, which may have been more problematic (Turnes & Ernst, 2016).

Conclusions

Findings from this study provided mixed support for the proposed hypotheses; despite limitations, preliminary evidence was provided for the indirect effect of hypomanic traits on exercise motives via overly-ambitious life goals. Although no associations were found between hypomanic traits and exercise behaviour itself, research has shown that exercise motives can predict behavioural regulation and exercise participation (Ingledew & Markland, 2008). Therefore, there may be an indirect effect of hypomanic traits and overly-ambitious life goals on exercise that would be of value to explore in future research.

Understanding these motivational processes may be of particular importance in BD, where there is a high mortality rate due to natural causes, which are potentially modifiable through exercise (Hayes et al., 2015). This understanding may inform future interventions that target sustained adherence to exercise. Therefore, future research exploring these variables in a clinical population and/or exploring causal relationships over time, would be a beneficial next step in eventually developing targeted SDT-informed exercise interventions for this population.

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Appendices

Appendix A: Hypomanic Personality Scale

Hypomanic Personality Scale (HPS; Eckblad & Chapman, 1986)

Instructions:

Please answer each item true or false. Please do not skip any items. It is important that you answer every item, even if you are not quite certain which is the best answer. An occasional item may refer to experiences that you have had only when taking drugs. Unless you have had the experience at other times (when not under the influence of drugs), mark it as if you have not had that experience.

Some items may sound like others, but all of them are slightly different. Answer each item individually, and don't worry about how you answered a somewhat similar previous item.

Circle either:

True False 1. I consider myself to be pretty much an average kind of person.

True False 2. It would make me nervous to play the clown in front of other people.

True False 3. I am frequently so “hyper” that my friends kiddingly ask me what drug I’m taking.

True False 4. I think I would make a good nightclub comedian.

True False 5. Sometimes ideas and insights come to me so fast that I cannot express them all.

True False 6. When with groups of people, I usually prefer to let someone else be the center of attention.

True False 7. In unfamiliar surroundings, I am often so assertive and

sociable that I surprise myself.

True False 8. There are often times when I am so restless that it is impossible for me to sit still.

True False 9. Many people consider me to be amusing but kind of eccentric.

True False 10. When I feel an emotion, I usually feel it with extreme intensity.

True False 11. I am frequently in such high spirits that I can't concentrate on any one thing for too long.

True False 12. I sometimes have felt that nothing can happen to me until I do what I am meant to do in life.

True False 13. People often come to me when they need a clever idea.

True False 14. I am no more self-aware than the majority of people.

True False 15. I often feel excited and happy for no apparent reason.

True False 16. I can't imagine that anyone would ever write a book about my life.

True False 17. I am usually in an average sort of mood, not too high and not too low.

True False 18. I often have moods where I feel so energetic and optimistic that I feel I could outperform almost anyone at anything.

True False 19. I have such a wide range of interests that I often don't know what to do next.

True False 20. There have often been times when I had such an excess of energy that I felt little need to sleep at night.

True False 21. My moods do not seem to fluctuate any more than most people's do.

True False 22. I very frequently get into moods where I wish I could be everywhere and do everything at once.

True False 23. I expect that someday I will succeed in several different professions.

True False 24. When I feel very excited and happy, I almost always know the reason why.

True False 25. When I go to a gathering where I don't know anyone, it usually takes me a while to feel comfortable.

True False 26. I think I would make a good actor, because I can play many roles convincingly.

True False 27. I like to have others think of me as a normal kind of person.

True False 28. I frequently write down the thoughts and insights that come to me when I am thinking especially creatively.

True False 29. I have often persuaded groups of friends to do something really adventurous or crazy.

True False 30. I would really enjoy being a politician and hitting the campaign trail.

True False 31. I can usually slow myself down when I want to.

True False 32. I am considered to be kind of a "hyper" person.

True False 33. I often get so happy and energetic that I am almost giddy.

True False 34. There are so many fields I could succeed in that it seems a shame to have to pick one.

True False 35. I often get into moods where I feel like many of the rules of life don't apply to me.

True False 36. I find it easy to get others to become sexually interested in me.

True False 37. I seem to be a person whose mood goes up and down easily.

True False 38. I frequently find that my thoughts are racing.

True False 39. I am so good at controlling others that it sometimes scares me.

True False 40. At social gatherings, I am usually the “life of the party”.

True False 41. I do most of my best work during brief periods of intense inspiration.

True False 42. I seem to have an uncommon ability to persuade and inspire others.

True False 43. I have often been so excited about an involving project that I didn’t care about eating or sleeping.

True False 44. I frequently get into moods where I feel very speeded-up and irritable.

True False 45. I have often felt happy and irritable at the same time.

True False 46. I often get into excited moods where it’s almost impossible for me to stop talking.

True False 47. I would rather be an ordinary success in life than a spectacular failure.

True False 48. A hundred years after I’m dead, my achievements will probably have been forgotten

Appendix B: BIS/BAS scales

BIS/BAS scales (Carver & White, 1994)

Each item of this questionnaire is a statement that a person may either agree with or disagree with. For each item, indicate how much you agree or disagree with what the item says. Please respond to all the items; do not leave any blank. Choose only one response to each statement. Please be as accurate and honest as you can be. Respond to each item as if it were the only item. That is, don't worry about being "consistent" in your responses. Choose from the following four response options:

1 = very true for me
2 = somewhat true for me
3 = somewhat false for me
4 = very false for me

1. A person's family is the most important thing in life.
2. Even if something bad is about to happen to me, I rarely experience fear or nervousness.
3. I go out of my way to get things I want.
4. When I'm doing well at something I love to keep at it.
5. I'm always willing to try something new if I think it will be fun.
6. How I dress is important to me.
7. When I get something I want, I feel excited and energized.
8. Criticism or scolding hurts me quite a bit.
9. When I want something I usually go all-out to get it.
10. I will often do things for no other reason than that they might be fun.

11. It's hard for me to find the time to do things such as get a haircut.
12. If I see a chance to get something I want I move on it right away.
13. I feel pretty worried or upset when I think or know somebody is angry at me.
14. When I see an opportunity for something I like I get excited right away.
15. I often act on the spur of the moment.
16. If I think something unpleasant is going to happen I usually get pretty

"worked up."

17. I often wonder why people act the way they do.
18. When good things happen to me, it affects me strongly.
19. I feel worried when I think I have done poorly at something important.
20. I crave excitement and new sensations.

21. When I go after something I use a "no holds barred" approach.
22. I have very few fears compared to my friends.
23. It would excite me to win a contest.
24. I worry about making mistakes.

Appendix C: WASSUP

The Willingly Approached Set of Statistically Unlikely Pursuits (WASSUP; Johnson & Carver, 2006)

For each item on this page, choose the answer (from the choices just below) that best reflects how likely you are to set that as a goal for yourself. Code that answer onto your answer sheet

1 = NO CHANCE I will set this goal for myself
2 = Slight chance I will set this goal for myself
3 = Moderate chance I will set this goal for myself
4 = Very good chance I will set this goal for myself
5 = Definitely WILL set this goal for myself

1. Celebrities will want to be your friends.
2. Each day of your work will be fulfilling.
3. Everyone you know will love you.
4. Someone will write a book about your life.
5. Whenever you have a problem, your friends will drop what they are doing to support you.
6. You will appear regularly on TV.
7. You will be famous.
8. You will be important in political circles.
9. You will be on a magazine list of the sexiest people alive.
10. You will be president of your country.
11. You will create a great work of art, music, or poetry.
12. You will create world peace.
13. You will develop a TV show or a movie.
14. You will do only things you really like to do, and nothing else.
15. You will enjoy every day to the max.
16. You will have 10 close friends.
17. You will have 100 friends.
18. You will have 20 million dollars or more.
19. You will have 40 close friends.
20. You will have a major role in a movie.
21. You will have a million dollars or more.
22. You will have more than 50 lovers in your lifetime.
23. You will have the closest family relationships imaginable.
24. You will run a Fortune 500 company.
25. You will self-actualize or reach Nirvana.
26. You will stop world hunger.
27. You will write a popular book.
28. Your children will see you as the perfect parent.
29. Your partner relationship will be sheer bliss for years.
30. Your relationship will be more romantic than Romeo and Juliet.

Appendix D: BREQ-2

BREQ-2 (Markland & Tobin, 2004)

WHY DO YOU ENGAGE IN EXERCISE?

We are interested in the reasons underlying peoples' decisions to engage, or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

		Not true for me		**Sometimes true for me**		**Very true for me**
1	I exercise because other people say I should	0	1	2	3	4
2	I feel guilty when I don't exercise	0	1	2	3	4
3	I value the benefits of exercise	0	1	2	3	4
4	I exercise because it's fun	0	1	2	3	4
5	I don't see why I should have to exercise	0	1	2	3	4
6	I take part in exercise because my friends/family/partner say I should	0	1	2	3	4
7	I feel ashamed when I miss an exercise session	0	1	2	3	4
8	It's important to me to exercise regularly	0	1	2	3	4
9	I can't see why I should bother exercising	0	1	2	3	4
10	I enjoy my exercise sessions	0	1	2	3	4
11	I exercise because others will not be pleased with me if I don't	0	1	2	3	4
12	I don't see the point in exercising	0	1	2	3	4
13	I feel like a failure when I haven't exercised in a while	0	1	2	3	4
14	I think it is important to make the effort to	0	1	2	3	4

	exercise regularly					
15	I find exercise a pleasurable activity	0	1	2	3	4
16	I feel under pressure from my friends/family to exercise	0	1	2	3	4
17	I get restless if I don't exercise regularly	0	1	2	3	4
18	I get pleasure and satisfaction from participating in exercise	0	1	2	3	4
19	I think exercising is a waste of time	0	1	2	3	4

Thank you for taking part in our research

Appendix E: EMI-2

EMI-2 (Markland & Ingledew, 1997)

On the following pages are a number of statements concerning the reasons people often give when asked why they exercise. *Whether you currently exercise regularly or not,* please read each statement carefully and indicate, by circling the appropriate number, whether or not each statement *is true* for you personally, *or would be true* for you personally if you did exercise. If you do not consider a statement to be true for you at all, circle the '0'. If you think that a statement is very true for you indeed, circle the '5'. If you think that a statement is partly true for you, then circle the '1', '2', '3' or '4', according to how strongly you feel that it reflects why you exercise or might exercise.

Remember, we want to know why *you personally* choose to exercise or might choose to exercise, not whether you think the statements are good reasons for *anybody* to exercise.

It helps us to have basic personal information about those who complete this questionnaire. We would be grateful for the following information:

Your age …… years **Your gender …… male/female**

		Not at all true for me					**Very true for me**
Personally, I exercise (or might exercise) …							
1	To stay slim	0	1	2	3	4	5
2	To avoid ill-health	0	1	2	3	4	5
3	Because it makes me feel good	0	1	2	3	4	5
4	To help me look younger	0	1	2	3	4	5
5	To show my worth to others	0	1	2	3	4	5
6	To give me space to think	0	1	2	3	4	5

7	To have a healthy body	0	1	2	3	4	5
8	To build up my strength	0	1	2	3	4	5
9	Because I enjoy the feeling of exerting myself	0	1	2	3	4	5
10	To spend time with friends	0	1	2	3	4	5
11	Because my doctor advised me to exercise	0	1	2	3	4	5
12	Because I like trying to win in physical activities	0	1	2	3	4	5
13	To stay/become more agile	0	1	2	3	4	5
14	To give me goals to work towards	0	1	2	3	4	5
15	To lose weight	0	1	2	3	4	5
16	To prevent health problems	0	1	2	3	4	5
17	Because I find exercise invigorating	0	1	2	3	4	5
18	To have a good body	0	1	2	3	4	5
19	To compare my abilities with other peoples’	0	1	2	3	4	5
20	Because it helps to reduce tension	0	1	2	3	4	5
21	Because I want to maintain good health	0	1	2	3	4	5
22	To increase my endurance	0	1	2	3	4	5
23	Because I find exercising satisfying in and of itself	0	1	2	3	4	5
24	To enjoy the social aspects of exercising	0	1	2	3	4	5
25	To help prevent an illness that runs in my family	0	1	2	3	4	5
26	Because I enjoy competing	0	1	2	3	4	5
27	To maintain flexibility	0	1	2	3	4	5
28	To give me personal challenges to face	0	1	2	3	4	5

29	To help control my weight	0	1	2	3	4	5
30	To avoid heart disease	0	1	2	3	4	5
31	To recharge my batteries	0	1	2	3	4	5
32	To improve my appearance	0	1	2	3	4	5
33	To gain recognition for my accomplishments	0	1	2	3	4	5
34	To help manage stress	0	1	2	3	4	5
35	To feel more healthy	0	1	2	3	4	5
36	To get stronger	0	1	2	3	4	5
37	For enjoyment of the experience of exercising	0	1	2	3	4	5
38	To have fun being active with other people	0	1	2	3	4	5
39	To help recover from an illness/injury	0	1	2	3	4	5
40	Because I enjoy physical competition	0	1	2	3	4	5
41	To stay/become flexible	0	1	2	3	4	5
42	To develop personal skills	0	1	2	3	4	5
43	Because exercise helps me to burn calories	0	1	2	3	4	5
44	To look more attractive	0	1	2	3	4	5
45	To accomplish things that others are incapable of	0	1	2	3	4	5
46	To release tension	0	1	2	3	4	5
47	To develop my muscles	0	1	2	3	4	5
48	Because I feel at my best when exercising	0	1	2	3	4	5
49	To make new friends	0	1	2	3	4	5
50	Because I find physical activities fun, especially when competition is involved	0	1	2	3	4	5
51	To measure myself against	0	1	2	3	4	5

personal standards

Thank you for completing this questionnaire

Appendix F: Principal Component Analysis

A PCA conducted for subscales on the EMI-2 (Table 3). The sub-scales challenge and ill-health avoidance were removed as they cross-loaded ambiguously across components. The PCA was then run for a second time, revealing three clear components (Table 4).

Table 3.

Principal Component Analysis for subscales of the EMI-2, with Oblimin rotation, converged in 10 iterations.

	Component 1	Component 2	Component 3
PH	.852		
SE	.778		
NI	.704		
SM	.684		
CH	.574	-.513	
IHA	.519	.400	.475
CO		-.901	
SR		-.717	.374
AF		-.617	
WM			.901
AP			.871
HP			.317

Note. PH = positive health; SE= strength and endurance; NI = nimbleness; SM = stress management; CO = competition; SR = social recognition; AF = affiliation; HP = Health pressures; WM = weight management; AP = appearance.

Table 4.

Principal Component Analysis for subscales of the EMI-2, following removal of challenge and ill-health avoidance subscales. Oblimin rotation used, converged in 10 iterations.

	Component 1	Component 2	Component 3
PH	.879		
SE	.802		
NI	.706		
SM	.683		
CO		-.941	
SR		-.758	
AF		-.672	
HP		-.313	
WM			.916
AP			.882

Appendix G: IPAQ-SF

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE- Short Form (Craig et al., 2003)

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

☐ No vigorous physical activities ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one

of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis?

Do not include walking.

_____ **days per week**

☐ No moderate physical activities ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don’t know/Not sure

This is the end of the questionnaire, thank you for participating.

Appendix H: PANAS

PANAS (Watson, Clark & Tellegen, 1988)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. Indicate the extent you have felt this way over the past week.

1	**2**	**3**	**4**	**5**
very slightly or not at all	a little	moderately	quite a bit	extremely

_____ interested

_____ distressed

_____ excited

_____ upset

_____ strong

_____ guilty

_____ scared

_____ hostile

_____ enthusiastic

_____ proud

_____ irritable

_____ alert

_____ ashamed

_____ inspired

_____ nervous

_____ determined

_____ attentive

_____ jittery

_____ active

_____ afraid

Appendix I: Ethical Approval

Dear Lucy Williams,

Application ID:	**eCLESPsy000075 v2.1**
Title:	**An exploration of the association between hypo-manic traits and exercise behaviour: the role of goals and motivation.**

Your e-Ethics application has been reviewed by the CLES Psychology Ethics Committee.

The outcome of the decision is: **Favourable**

Potential Outcomes

Favourable:	The application has been granted ethical approval by the Committee. The application will be flagged as Closed in the system. To view it again, please select the tick box: View completed
Favourable, with conditions:	The application has been granted ethical approval by the Committee under the provision of certain conditions. These conditions are detailed below.
Provisional:	You have **not** been granted ethical approval. The application needs to be amended in light of the Committee's comments and re-submitted for Ethical review.
Unfavourable:	You have **not** been granted ethical approval. The application has been **rejected** by the Committee. The application needs to be amended in light of the Committee's comments and resubmitted / or you need to complete a new application.

Please view your application here and respond to comments as required. You can download your outcome letter by clicking on the 'PDF' button on your eEthics Dashboard.

If you have any queries please contact the CLES Psychology Ethics Chair: **Lisa Leaver** L.A.Leaver@exeter.ac.uk

Kind regards,
CLES Psychology Ethics Committee

Appendix J: Participant Information

Participant Information for Initial Survey

PARTICIPANT INFORMATION PAGE - PLEASE READ BEFORE PROCEEDING

Name of researcher: Lucy Williams

Thank you for considering taking part in the following research study. This study is a third year Clinical Psychology major research project that aims to investigate the relationships between goal setting, motivation and exercise. The measures used in this study do not require you to be exercising regularly.

Please read the following information carefully before deciding whether or not you wish to continue with participation. You can contact the researcher with any questions you may have, contact details can be found below.

What is involved with taking part?

This study is an online survey and will ask you some questions regarding a number of different areas, these include: your physical activity in the previous 7 days, reasons why you may exercise and some further questions regarding your emotions, personality and sensitivity to reward. These questions require you to either give a true/false response or a number based on rating scales. You are able to omit any answers you do not wish to give. This survey will take approximately 40 minutes.

You will then be asked to complete a follow up survey the following week; this will take approximately 5 minutes. It will ask about your physical activity and emotions over the previous week. For the follow up survey, you will be contacted by email containing a link to fill in the survey. Total participation over the two weeks should take around 45 minutes.

What will I receive for taking part?

To thank you for participating in this study, those taking part through the Psychology Research Participation Scheme will receive 1.5 course credits for completing both parts of the study, one course credit will be given for completing the first section, the other 0.5 credit given for the 5 minute follow up. Other participants will be entered into a prize draw to win one of eight £25 Amazon vouchers, you will be entered once for completing each part of the study and will therefore be entered twice for completing the entire study. It is anticipated that the chance of winning will be between 1 in 3 and 1 in 10.

What happens to my information?

All data will be kept confidential. Your email address will be retained to send emails for the follow up survey and for you to be entered into the prize draw; they will be deleted following contact with the winners. The anonymised raw

data will be retained securely for a period of 7 years. All personal data will be stored separately from the raw data collected and will only be linked by a code number. Confidentiality would only be broken under circumstances where you or someone else is believed to be at immediate risk.

Do I have to take part?

Your participation in this study is voluntary and you may omit any answers you do not wish to give or withdraw from the study at any time.

Where will the results be shown?

The results from this study aim to be published in a peer reviewed journal. The final report will also be published via Open Research Exeter (ORE). No identifying information will be included in any publication. You may contact the researcher if you wish to be provided with the findings from this study.

Contact details

If you have any questions about participating in this study or would like any further information, the researcher can be contacted by email on: lw448@exeter.ac.uk

Participant Information for Follow-up Survey

Name of researcher: Lucy Williams

Thank you for taking part in the follow up survey for this study.

This study is a third year Clinical Psychology major research project that aims to investigate the relationships between goal setting, motivation and exercise. The measures used in this study do not require you to be exercising regularly.

In the first survey, you read a participant information page and gave consent to participate in this study. Please be reminded of the following:

- This follow up survey will ask you some questions regarding your physical activity in the previous 7 days and your emotions. You are able to omit any answers you do not wish to give. This survey will take approximately 5 minutes.
- To thank you for participating in this follow up study, those taking part through the Psychology Research Participation Scheme will receive a further 0.5 course credit. Other participants will be entered into a prize draw to win one of eight £25 Amazon vouchers for a second time, increasing your chance of winning!
- All data will be kept confidential. Your email address will be retained for participants to be entered into the prize draw; they will be deleted following contact with the winners. The anonymised raw data will be retained securely for a period of 7 years. All personal data will be stored

separately from the raw data collected and will only be linked by an ID number.
- Confidentiality would only be broken under circumstances where you or someone else is believed to be at immediate risk.
- You may withdraw from the study at any time.
- The results from this study aim to be published in a peer reviewed journal. The final report will also be published via Open Research Exeter (ORE). No identifying information will be included in any publication. You may contact the researcher if you wish to be provided with the findings from this study.

By continuing with this survey, you are confirming that you still consent to participating.

Contact details

If you have any questions about participating in this study or would like any further information, the researcher can be contacted by email on: lw448@exeter.ac.uk

Appendix K: Consent Form

Name of Researcher: Lucy Williams (lw448@exeter.ac.uk)

Please complete the below questions to confirm that you give your consent to complete the following study.

*ID Number
Please give your unique ID number that was emailed to you by the researcher along with the link to this survey. You will also need this ID to complete the follow up survey in a week.

Gender *Choose one of the following answers*
Male
Female
Other

*I confirm I am over 18 years of age
Yes
No

*I confirm that I have read and understood the participant information page
Yes
No

*I understand that my information and the data I provide will be kept confidential
Yes
No

*I understand that I am able to withdraw from this study at any time and do not have to provide a reason.
Yes
No

*I consent to taking part in this study
Yes
No

Appendix L: Debrief

Thank you for participating in this study, your contribution is really appreciated.

Why we are conducting this study

This study was designed to explore exercise goals, exercise motivation and their associations with hypomanic traits and exercise participation. High incidence of hypomanic traits can be indicative of a risk of developing bipolar disorder (BD). This study was therefore an initial step in exploring associations between exercise goals in BD and exercise participation. The findings from this study could lead to further exploration of these factors in a clinical population of individuals with BD.

Based on previous studies of goal setting in BD and contemporary theoretical perspectives on motivation and exercise, this study proposes that hypomanic traits will be associated with exercise goals that are more focused on obtaining rewards separate from the exercise itself, such as to look good rather than the enjoyment or challenge of the exercise. It also proposes that these individuals are perhaps less likely to sustain exercise over time.

By gaining a more comprehensive understanding of goal content and motivation for exercise, specific interventions could be developed in the future that will increase sustained adherence to exercise programs in individuals with BD. This may be particularly important because there is an association between BD and high rates of physical health problems and mortality due to natural causes. Exercise has also been found to improve depressive symptoms, functioning and quality of life in individuals in this population.

Seeking help

This study was looking at goals and exercise in relation to hypomanic traits. An association has been found been high levels of hypomanic traits and risk for developing Bipolar Disorder. If any of the questions answered caused any concern about your own mental health please speak to your GP.

For confidential support for anyone experiencing feelings of distress or despair you can contact The Samaritans on 116 123 (free 24-hour helpline) or www.samaritans.org.uk

For more information on Bipolar Disorder please see the links below:

www.bipolaruk.org/

www.mind.org.uk

Contact details

If you have any further questions about this study or would like to be provided with the findings from this study, the researcher can be contacted by email on: lw448@exeter.ac.uk

Details of the Chair of the Psychology Ethics Committee can be found below:

Dr Lisa Leaver

Chair of the Psychology Ethics Committee

University of Exeter

L.A.Leaver@exeter.ac.uk

Appendix M: Mediation Analyses for Hypothesis 3

Mediation analyses were conducted to explore the mediating role of motivation for exercise on relationship between exercise motives and exercise behaviour both cross-sectionally and prospectively. No significant indirect effects were found. Figure 6 shows the results of the effect of HF motives on exercise through behavioural regulations at baseline. Figure 7 and 8 shows the results for the same mediations run for SE and WA motives respectively. Figure 9 shows the results of the effect of HF motives on exercise through behavioural regulations at follow-up. Figure 10 and 11 shows the results for the same mediations run for SE and WA motives respectively.

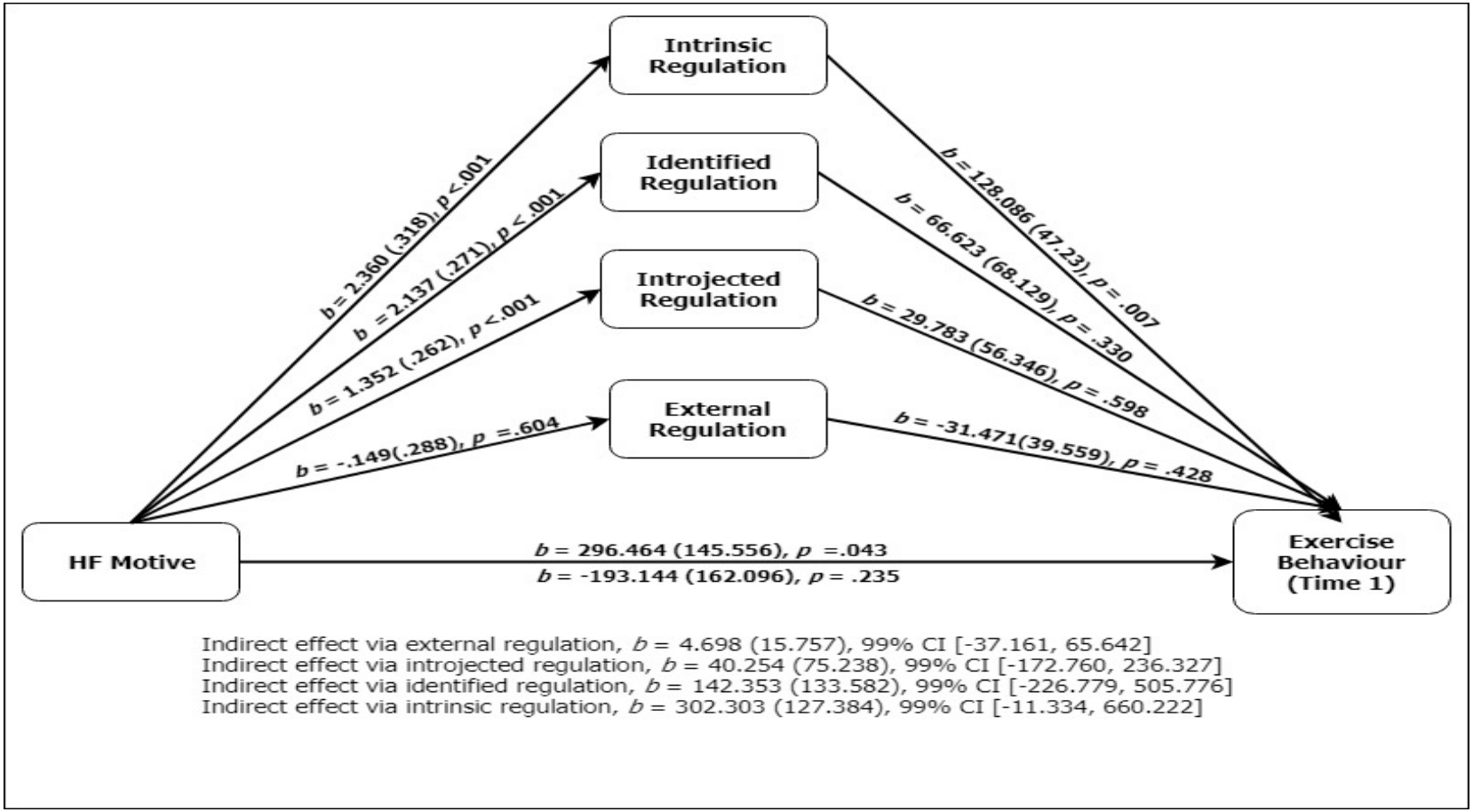

Figure 6. Results of mediation analyses exploring the effect of HF motives on exercise behaviour through behavioural regulations at baseline.

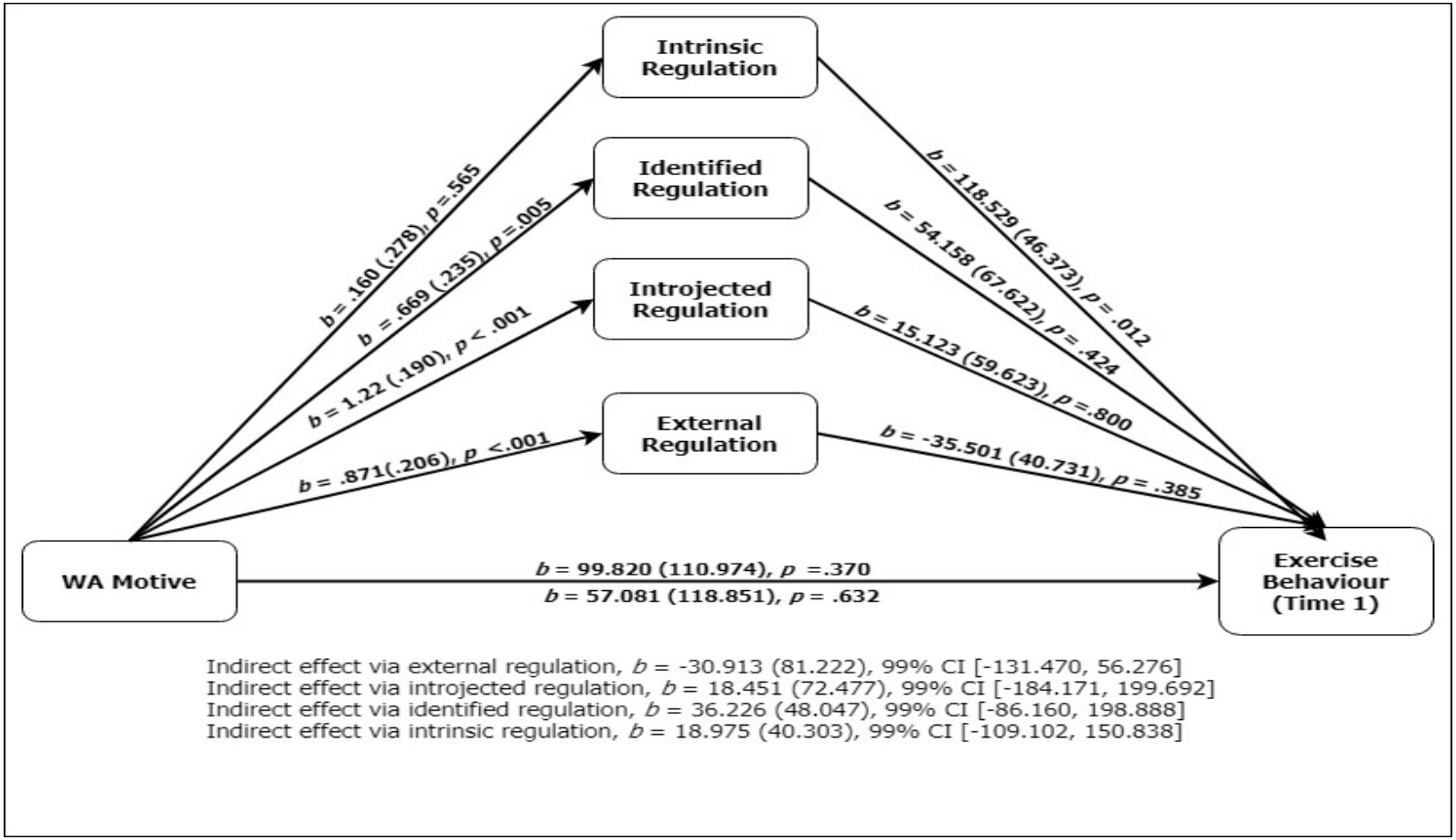

Figure 7. Results of mediation analyses exploring the effect of WA motives on exercise behaviour through behavioural regulations at baseline.

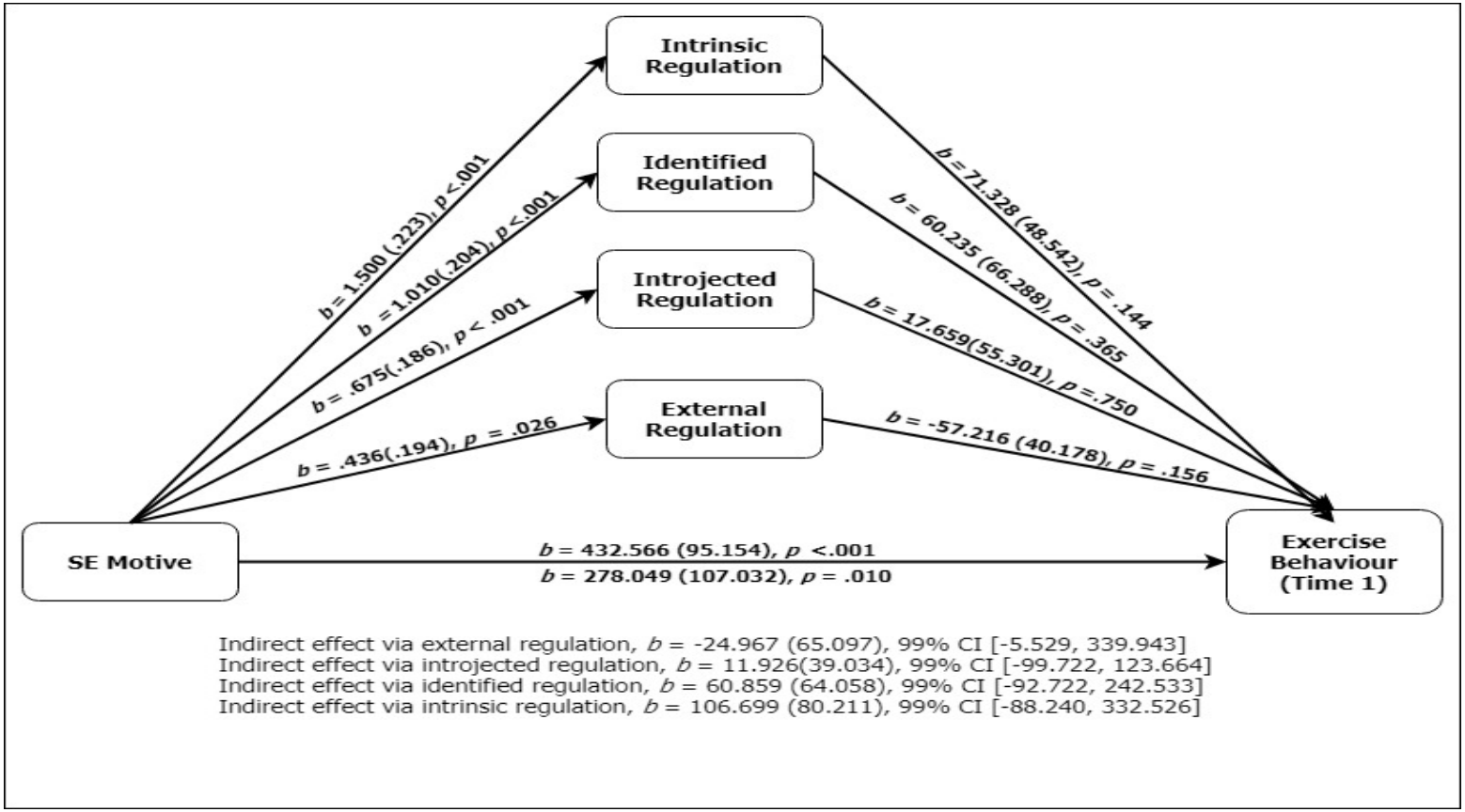

Figure 8. Results of mediation analyses exploring the effect of SE motives on exercise behaviour through behavioural regulations at baseline.

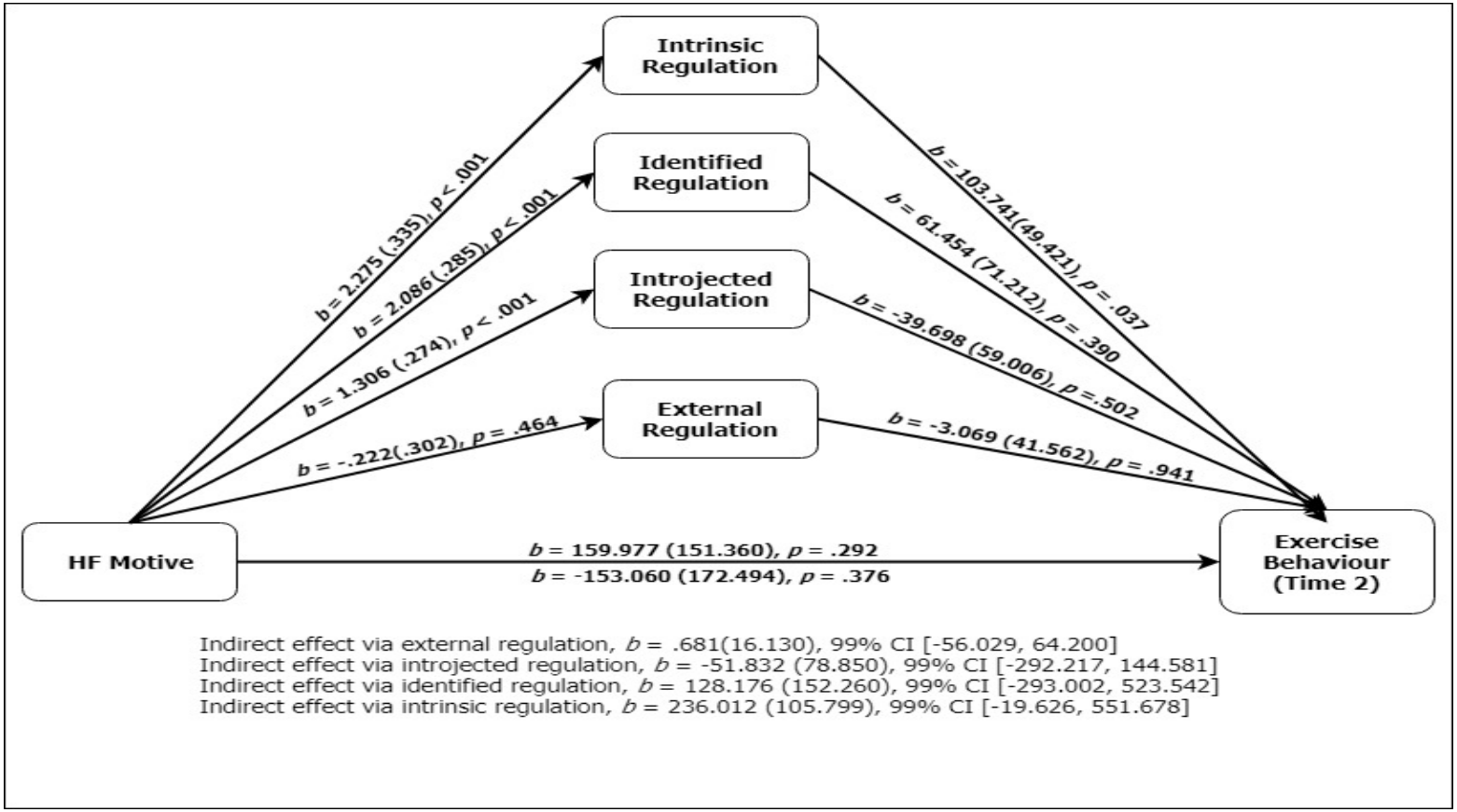

Figure 9. Results of mediation analyses exploring the effect of HF motives on exercise behaviour through behavioural regulations at follow-up.

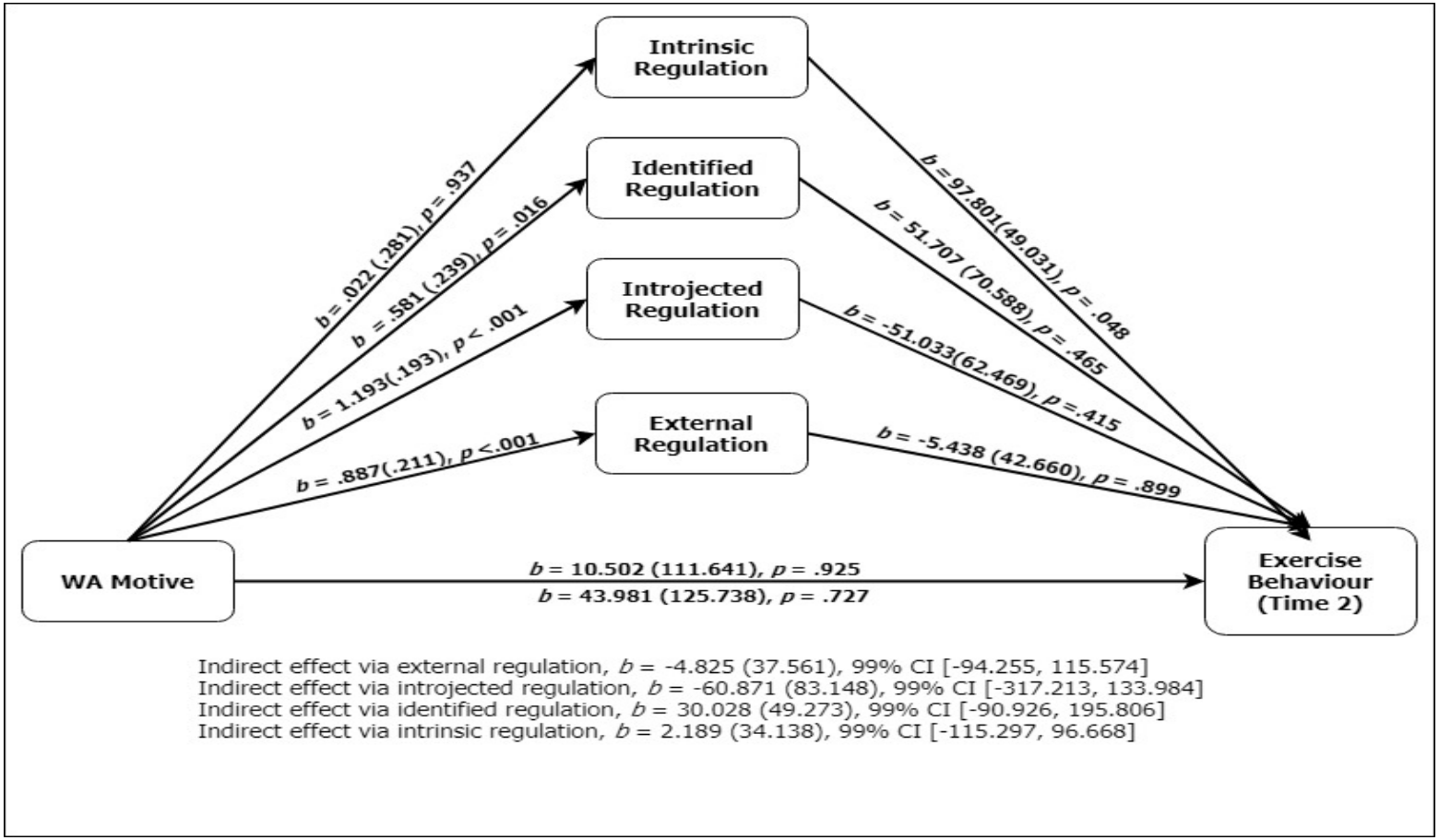

Figure 10. Results of mediation analyses exploring the effect of WA motives on exercise behaviour through behavioural regulations at follow-up.

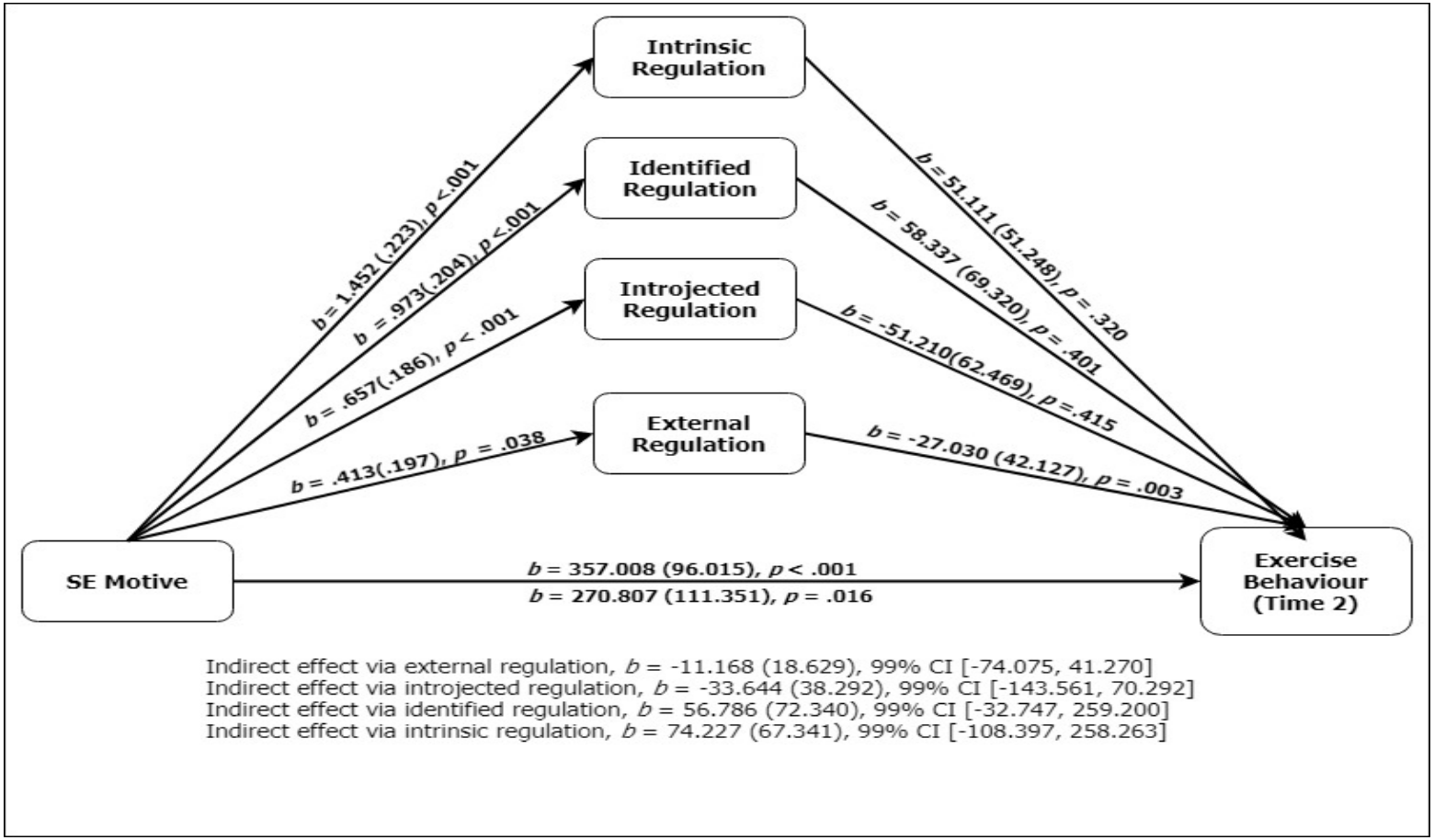

Figure 11. Results of mediation analyses exploring the effect of SE motives on exercise behaviour through behavioural regulations at follow-up.

Appendix N: Dissemination Statement

Dissemination of the results from this study will predominantly involve presentation, journal publication and feedback on request.

Presentation

Presentations have been scheduled to take place at the University of Exeter in June 2018 to disseminate the findings of this study to staff and peers.

Publication

The literature review and empirical paper will aim to be submitted to the peer-reviewed journal Mental Health and Physical Activity, instructions for manuscript preparation can be found in Appendix O.

Feedback to Participants

Participants involved in this study will not be provided with feedback; however, the information and debrief pages indicate that they are able to contact the researcher should they wish to be informed as to the results of the study.

Appendix O: Preparation and Submission Requirements for Mental Health and Physical Activity (MENPA)

Mental Health and Physical Activity is an international journal looking to advance the understanding of the relationship between mental health and physical activity. Manuscripts which deal with high quality research, comprehensive research reviews, and critical reflection of applied or research issues will be considered for publication.

Preparation

Cover letter. The cover letter accompanying the manuscript submission must include all authors' names and affiliations to avoid potential conflicts of interest in the review process. An address, phone number, email address and fax number should be provided for the corresponding author for possible use by the editorial office and later by the production department. The cover letter should indicate any potential conflicts of interest (e.g., commercial sponsorship). The source of any funding that may have contributed to the production of the research and/or manuscript should be declared in the cover letter, and if the manuscript is accepted for publication, as an acknowledgement in the published paper.

General. Manuscripts should be prepared following the general style guidelines described in the Publication Manual of the American Psychological Association (Latest Edition). Do not import the Figures or Tables into your text. The Editors reserve the right to adjust style to certain standards of uniformity.

Paper Length. All manuscripts should be presented as concisely as possible, and our preference is to receive manuscripts that are 30 A4, double spaced pages or less (APA format), including text, references, figures, and tables. For longer

manuscript, authors should contact an Editor in Chief prior to submission with a clear justification for the need for a longer manuscript. Short Communications are also accepted and encouraged. These are typically no more than 15 A4, double spaced pages (APA format). Occasionally other forms of submission may be of interest to the Editors/readers such as book reviews, commentaries, and news items.

This journal uses double-blind review, which means the identities of the authors are concealed from the reviewers, and vice versa. More information is available on our website. To facilitate this, please include the following separately: Title page (with author details): This should include the title, authors' names, affiliations, acknowledgements and any Declaration of Interest statement, and a complete address for the corresponding author including an e-mail address. Blinded manuscript (no author details): The main body of the paper (including the references, figures, tables and any acknowledgements) should not include any identifying information, such as the authors' names or affiliations.

Title Page

- The title should be concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
- Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. You can add your name between parentheses in your own script behind the English transliteration.
- Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lowercase superscript letter immediately after the author's name and in front of the appropriate address.

Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.

- Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. This responsibility includes answering any future queries about Methodology and Materials. Ensure that the e-mail address is given and that contact details are kept up to date by the corresponding author.
- If an author has moved since the work described in the article was done, or was visiting at the time, a 'Present address' (or 'Permanent address') may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Abstract

Abstract Papers should include an abstract, not exceeding 250 words, covering the main factual points and statement of problem, method, results and conclusions.

Highlights

Highlights are mandatory for this journal. They consist of a short collection of bullet points that convey the core findings of the article and should be submitted in a separate editable file in the online submission system.

Keywords

Authors are requested to supply a maximum of 6 keywords accurately describing the contents of the manuscript. These are normally not words used in the title.

Tables

Please submit tables as editable text and not as images. Tables can be placed either next to the relevant text in the article, or on separate page(s) at the end. Number tables consecutively in accordance with their appearance in the text and place any table notes below the table body. Be sparing in the use of tables and ensure that the data presented in them do not duplicate results described elsewhere in the article. Please avoid using vertical rules and shading in table cells.

Figures

Aim to use the following fonts in your illustrations: Arial, Courier, Times New Roman, Symbol, or use fonts that look similar.

- Number the illustrations according to their sequence in the text.
- Use a logical naming convention for your artwork files.
- Provide captions to illustrations separately.

Ensure that each illustration has a caption. Supply captions separately, not attached to the figure. A caption should comprise a brief title (not on the figure itself) and a description of the illustration. Keep text in the illustrations themselves to a minimum but explain all symbols and abbreviations used.

Referencing

References should be prepared using the Publication Manual of the American Psychological Association (6th Edition) for style.